Cognitive and behavioural profiles of autism and Asperger's syndrome: are they distinctive?

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I declare that this thesis is my own work and that, to the best of my knowledge and belief, it does not contain material from published sources without proper acknowledgement, nor does it contain material which has been accepted for the award of any other higher degree or graduate diploma in any university.

Signed:

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Contents

Abstract

This literature review examines the emergence of the diagnostic criteria of Pervasive Developmental Disorders, focusing on autism and Asperger's Syndrome. Autism first described by Leo Kanner in 1943 was originally identified as a form of childhood schizophrenia, and was first recognised as a distinct disorder in 1980. In 1944 Hans Asperger identified children who appeared to have autism but were more able in their use of language and social interactions than children with autism. The current diagnostic criteria and identifying markers which differentiate the two disorders are critically examined, and the challenges in accurately diagnosing individuals with these pervasive developmental disorders are presented. Asperger's Syndrome is currently indicated by several deficits shared with autism: impairments in social interaction, communication and the presence of repetitive behaviours. The fact that they share many similar characteristics has led to questions of whether the two disorders can be reliably differentiated in terms of symptom profiles. Hence, the current research being undertaken to distinguish attributes that separate the disorders from one another is critically reviewed in the light of two opposing constructs; the first being that autism and Asperger's Syndrome are distinct disorders with differing clinical features, the second being the idea of the two disorders exist on a continuum differing only in terms of severity. The review found that the contradictions in the literature have made it difficult for reliable diagnoses to be made and that research needs to focus on finding clear indicators that can either objectively separate the two disorders or conclusively argue that they cannot be differentially diagnosed based on their symptom profiles.

The aim of this literature review is to critically examine the identification and diagnosis of autism and Asperger's Syndrome in the context of recognised general difficulties that are associated with the diagnosis of mental disorders. The development of diagnostic criteria and identifying markers which differentiate the two disorders are examined. In particular, the review focuses on the difficulty in accurately diagnosing individuals with pervasive developmental disorders and of the current research being undertaken to distinguish attributes that reliably separate the disorders from one another.

Diagnosis and Classification of Mental Disorders

The classification of mental disorders has evolved significantly over the past 50 years. Initial attempts to classify mental disorders were focused on aetiologically-based classifications and broad symptom descriptions not necessarily supported by empirical evidence. But with the development of the Diagnostic and Statistical Manual of Mental Disorders, third edition (DSM-III, APA, 1980), a more descriptive and criterion-based classification system evolved. The DSM-III attempted to reduce diagnostic confusion by basing diagnosis on observable symptoms, providing a common language for the psychiatric community and encouraging systematic empirical research. There was an assumption that classifying disorders based on diagnostic features rather than aetiology would provide more reliability and consistency in different cases.

The DSM classification systems have been developed based on the medical model with an underlying assumption of physical symptomatology. The medical model has a long history of being able to provide clear and consistent criteria in order for diagnoses to be made. For a disease such as *infectious mononucleosis*, or Glandular Fever as it is more

commonly known, symptoms include sore throat, swollen tonsils, enlarged and sore lymph nodes, flu-like symptoms and fatigue. A doctor can collect information about a person's symptoms, most of which can either be viewed as present or absent and then make a conclusion about a diagnosis. While these symptoms may possibly indicate other illnesses or diseases, a blood test can then confirm the presence of Glandular Fever. One of the reasons why this model of diagnosis is so successful for medical conditions is that physical symptoms are easily observed and the symptoms will generally look the same for each individual.

When applying this type of diagnostic model to mental disorders, there are generally not always such clear-cut examples of the set of criteria used to define the disorder. Rather than an unambiguous presence or absence of a condition or syndrome, at times the diagnostic process relies on a cut-off point that arbitrarily distinguishes between normality and a disordered state.

Using a medical model to diagnose mental disorders has proven to be problematic. Firstly, there is a general assumption that there is a clear distinction between cases and non-cases. In medical cases, it is easy to determine whether an individual is presenting with the designated set of physical symptoms due to their greater observability. But for mental disorders, determining the severity of deviance is dependent on individual opinion, and is vulnerable to the subjectivity and biases of different clinicians. When measuring behavioural characteristics of individuals, it is considerably more difficult to identify symptoms, as their presentation can differ significantly over time, place and person.

Classification systems such as the DSM have met with criticism over recent years and alternative systems have been proposed. One alternative to the categorical system is a dimensional approach with the assumption that disorders exist on a continuum. Using depression as an example, rather than an individual meeting a defined set of criteria in order to determine whether they have depression or not, evidence suggests that depression exists on a continuum from mild dysphoria to full blown clinical depression. A dimensional approach would assist in providing a change from simply distinguishing between normality and the presence of a disorder and instead develop more meaningful points of demarcation along a continuum with these points being labelled with descriptors such as mild, moderate and severe. This may in fact follow more closely with how clinicians make diagnoses in clinical practice (Luyten & Blatt, 2007).

Autism is a disorder with a long history of evolving diagnostic criteria and one that struggles with criterion-based classification systems in which individuals have to meet a certain number of criteria in order to receive a diagnosis. Having to base a diagnostic decision primarily on subjective behavioural observations diminishes reliability and the current system has been criticised for not accounting for symptom heterogeneity in individuals with autism (Beglinger & Smith, 2001; in van Lang et al., 2006). Wing commented in her 2005 paper on Asperger's Syndrome that establishing criteria for any syndrome defined solely on aspects of behaviour is difficult or impossible.

Diagnosis and Classification of Autism

Autism is a developmental delay characterised by deficits in communication, play, and social skills. Often described as aloof and withdrawn, individuals meeting the criteria

for autism demonstrate a desire for routine and the need to engage in repetitive behaviours. Autism is currently considered diagnostically as one of a number of subgroups within the Pervasive Developmental Disorders along with Asperger's Syndrome, Rett's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorder – Not Otherwise Specified. However, this was not always the case. In the 1930s, the term Childhood Schizophrenia served as a general label for such childhood disturbances until 1943 when Leo Kanner described what he called *early infantile autism,* arguing that it was different from other cases of severe disturbance, which often had a later onset (Wicks-Nelson & Israel, 1997). Although not labelled until the 1940s, cases of autism (as we know it) have been documented in the literature as early as the 1700s. Wolff (2004) describes a 1747 legal case in Scotland documenting a man with deficits in social relationships (tactlessness and abnormal gaze), abnormality of language (echolalia) and obsessive and repetitive behaviour (odd motor mannerisms, insisting domestic objects remain in the same place). In 1800, a Frenchman, Itard, reported capturing a boy, aged approximately 12 years, labelled the "Wild Boy of Averyon", who was very self-absorbed and could not verbally communicate. Nearly 100 years after this report, M.W.Barr, a psychologist wrote an article published in the Journal of Nervous Mental Diseases titled "A note on Echolia, with the report of an extraordinary case" describing his encounter with a 22-year-old man with a phenomenal memory and echolalic speech.

Kanner's Identification of Autism

The term *autistic* comes from the Greek word "autos" and means an absorption in the self or subjective mental activity. In the early 1940s, Kanner first applied this term to

children who presented with an inability to relate to people and situations from the beginning of life. He also described communication deficits, good but atypical cognitive potential and behavioural problems such as obsessiveness, repetitious actions and unimaginative play (Wicks-Nelson & Israel, 1997).

Kanner listed five criteria defining the syndrome: 1) profound lack of affective contact; 2) anxious desire for the preservation of sameness; 3) fascination with objects that are handled with skill; 4) mutism or language that does not serve interpersonal communication; and 5) good cognitive potential shown by feats of memory, or skills on performance tests (Wing, 1988). However, Kanner has been censured for not specifying clearly enough what were the necessary and sufficient signs and symptoms or most critically, how they were to be accurately defined and measured (Priory & Werry, 1986; cited Werry, 1988). Regardless of the debate relating to the interpretation of Kanner's findings, his original paper (1943) continues to be one of the most cited papers in autism literature and there can be little doubt that it remains enormously influential in current thinking in autism.

Despite their ground breaking nature, some of Kanner's original concepts have subsequently been found to be incorrect (Gillberg 1992). In 1960, Kanner was quoted by Time Magazine as saying that children with autism were the offspring of "parents, cold and rational, who just happened to defrost long enough to produce a child" (Steffenburg & Gillberg, 1989, as cited in Gillberg, 1992). Numerous studies, however, have provided solid evidence that parents of children with autism are as sociable, demonstrative and emotionally responsive as other parents and they do not differ in

infant acceptance, warmth, nurturing, feeding, and tactile or general stimulation (De Myer et al., 1972b; McAdoo & De Myer, 1978a, cited in DeMyer et al., 1981). After reviewing the available family research at the time, McAdoo and DeMyer (1978) concluded that as a group, parents of children with autism do not have extreme personality traits such as coldness, obsessiveness, social anxiety, or rage; nor do they possess any specific deficits in infant and child care. Kanner also believed that the families of individuals with autism were predominately from the upper socioeconomic class, but at least ten population studies have shown normal distribution of social class and research has shown that children with autism are not neurologically normal (Gillberg, 1992).

It was also Kanner, in the face of evidence to the contrary in his own writings, who said that the children with autism were not neurologically impaired. He asserted that people with autism were of potentially superior intelligence without citing any evidence for this assertion (Gillberg, 1992). For over two decades after this, diagnosis was generally one-dimensional; a child was either labelled as having infantile autism or mental retardation, not both (DeMyer et al., 1981). Nonetheless, an earlier study of intelligence estimates found 74% of children with autism had a general IQ score below 52 (DeMyer, Barton, DeMyer, Norton, Allen & Steele, 1974).

Despite some limitations, Kanner's work did provide the foundation of a body of research and the beginning of some clear definitions to separate individuals presenting with what became known as autism from other disorders of childhood. With the publication of the first Diagnostic and Statistical Manual of Mental Disorders (1952),

children presenting with autistic-like symptoms as described by Kanner were diagnosed as having Schizophrenic Reaction, Childhood Type, with autism being described as a psychotic reaction.

Differentiation of Autism from Schizophrenia

During the 1960s there was no consensus among researchers about features that distinguished between the diagnostic entities of Infantile Autism and Childhood Schizophrenia (DeMyer, Hingtgen & Jackson, 1981). Already discussions relating to continuity versus discontinuity had commenced with three areas of research emerging. Hingtgen and Bryson (1972) identified a group of investigators who proposed that Autism and Childhood Schizophrenia form a single diagnostic category, Childhood Psychosis, determined by similar presentations and prognosis. A second group viewed autism as one distinguishable type of Childhood Schizophrenia, while a third group purported Autism to be distinctly different from Childhood Schizophrenia. The DSM-II (American Medical Association, 1968) included only the diagnosis Childhood Schizophrenia, did not include autism as a separate diagnosis and merely described a set of behaviours as "autistic, atypical and withdrawn" (see Appendix A for the diagnostic criteria used in the DSM-II). The criteria alluded to the idea that intellectual disability, or mental retardation, was not uncommon for individuals who presented with these deficits.

An alternate diagnostic system to DSM, the Group for the Advancement of Psychiatry (GAP, 1966; cited Waterhouse et al., 1992), included a distinction between autism and schizophrenia offering three categories of psychotic disorders; psychoses of infancy and

childhood, psychoses of later childhood and psychoses of adolescence. Psychoses of infancy and childhood included autism, interactional psychotic disorder and other psychoses of infancy and childhood, whereas schizophrenic disorder is listed under psychoses of adolescence. The proposed classification system did not include any specific criteria in each of these sections, but instead it included a description of each disorder (see Appendix B for the Classification of Psychoses of Infancy and Childhood).

It is interesting to note that the (1966) Group for the Advancement of Psychiatry criteria appear to differentiate between schizophrenia and autism by age of onset, but they are more descriptive than the DSM system in outlining the symptoms present in each disorder. For example, when describing early infantile autism, the classification includes many features included in Kanner's (1943) original five criteria, including poor communication skills, preoccupation with objects and resistance to change. The classification system also differentiates between children who have demonstrated symptoms from birth or a young age, and children who have typical development for the first few years before showing signs of developmental regression. Also under the heading of Psychotic Disorders, the classification system includes two other subcategories; Psychoses of Later Childhood and Psychoses of Adolescence. The former includes a description for Schizophreniform psychotic disorder, while Schizophrenic disorder; adult onset is listed under Psychoses of Adolescence.

In the decade of the 1970s, over 1,100 research articles were published relating to infantile autism, childhood schizophrenia and related disorders (DeMyer, Hingtgen & Jackson, 1981). In a review of these articles, the major problem identified by the

authors was the inconsistent use of terminology referring to the various disorders included with the term "early childhood psychosis". Infantile autism, childhood schizophrenia, early childhood schizophrenia, early infantile psychosis and symbiotic psychosis are some examples of the names used for the subcategories of early childhood psychosis with no clear definition or criteria applied to the titles in order to distinguish the different terms. In fact, several diagnostic criteria from this period refer to "autistic behaviour" with no definition given to indicate whether they are referring to Kanner's earlier description of autism or something entirely different.

By 1979, the idea that autism may be an early form of childhood schizophrenia was abandoned (Wolff, 2004), and there was ample evidence to support the idea of autism being an independent clinical syndrome. Also in 1979, a paper by Wing and Gould was published documenting a study of children living in the London area with disabilities. By examining children with any feature of autistic behaviour, not just those exhibiting Kanner's autism, a hypothesis was developed suggesting that there was, in fact, a wide spectrum of "autistic conditions of which Kanner's autism was only one small part" (Wing & Gould 1979; cited in Wing, 1997 p.19). From here the idea that several related disorders existed on a continuum, with autism being one of the most severe, was developed. According to Wing (1997), conditions forming the autism spectrum share three underlying impairments; social interaction, communication and imagination. This study also identified several children with the same pattern of behaviour which had earlier been described by Hans Asperger in 1944.

Autism and the Pervasive Developmental Disorders

The 1980 introduction of the DSM-III (APA, 1980) separated pervasive developmental disorders into three categories; Infantile Autism (full syndrome or residual), Childhood onset pervasive developmental disorder (full syndrome or residual) and Atypical pervasive developmental disorder – Adult-type schizophrenia with onset in childhood. The DSM-III required that in order for a child to meet criteria for Infantile Autism, symptoms needed to be present before 30 months, which became particularly problematic if parents were presenting children who were older than three years and were required to retrospectively describe the presence or absence of behaviours they were not aware they had to look for (see Appendix A for diagnostic criteria).

For the first time since it was initially described, autism was classified in the 1980 DSM-III (APA, 1980) as a disorder in its own right and was separated from schizophrenia, specifying that an absence of delusions and hallucinations were necessary to obtain a diagnosis. The DSM-III provided more clearly defined behavioural characteristics including a lack of response to others, deficits in language development, peculiar speech patterns and gave examples of the occurrence of unusual behaviour patterns including resistance to change and restricted interests.

Numerous problems arose from the definitions adopted by the DSM classification system, for example, many children with autism did not meet the arbitrarily determined number of criteria for a diagnosis of autism. Clinicians were then faced with the process of "fitting" a different diagnosis and thus began using the terms *autistic-like* or *language-disordered with autistic features* in order to prescribe effective intervention

(Pelios & Lund, 2001). While the diagnostic criteria used in the DSM-III were quite ambiguous, referring to "gross language deficits" and "bizarre responses to various aspects of the environment", they became more restrictive than the previous criteria outlined in the DSM-II. For diagnosis in the DSM-II, individuals needed to demonstrate autistic and withdrawn behaviours, uneven development and an inability to develop an identity separate to their mother before puberty. With the development of the DSM-III, children who did not exhibit symptoms until after the age of 30 months and did not demonstrate any resistance to change, for example, would not meet the prescribed criteria.

The DSM-III-R, introduced in 1987, made further changes surrounding the diagnosis and classification of Pervasive Developmental Disorders. Two subgroups remained – Autistic Disorder, which replaced Infantile Autism, and Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS), which replaced Atypical Pervasive Developmental Disorder. Appendix C outlines the diagnostic criteria used in the DSM-III-R.

By far, one of the most significant changes identified with the revisions for the DSM-III-R was the change in age of onset. This criterion had played a major part in the differential diagnosis between Infantile Autism and Childhood Onset Pervasive Developmental Disorder. However Rutter (1983; cited in Waterhouse et al., 1992), pointed out that the issue is not the age of onset of autistic symptoms but whether there has been a period of unambiguously normal development that extends up to three years of age. Therefore, changes were made to ensure that age of onset was not a criterion for

Autistic Disorder, however, if onset was determined to be after 36 months, the diagnosis should be specified as "childhood onset" (see Appendix C). Childhood Onset Pervasive Developmental Disorder was eliminated with the publication of the DSM-III-R in 1987, since very few cases were discovered and those that were found could not be distinguished from cases with Autistic Disorder.

The DSM-III-R first introduced three core areas of deficit; social interaction, communication and a restricted range of activities or interests. The diagnostic criteria for Autistic Disorder went much further in creating clear behavioural definitions for clinicians to base their diagnostic decisions and provided descriptions of behaviours that could be easily observed and noted as being present or absent.

Research continued during the 1980s to focus on clearly defining autism and pervasive developmental disorders. In 1988, Wing described a typology of Autism Spectrum Disorders which gave rise to the idea of various social subgroups being arranged in order of severity along a continuum. Wing proposed that the central deficit concerning autism is an "intrinsic impairment in development of the ability to engage in reciprocal social interaction" (p.92). Social impairment is often accompanied by impairments in other psychological functions such as communication, imagination, cognitive skills and patterns of behaviour in varying combinations meaning the continuum would be quite complex. While some of the more commonly observed combinations of symptoms at particular severity levels have been named as syndromes, autism and Asperger's Syndrome in particular, Wing (1988) reported that other combinations of impairments have not yet been as clearly defined.

Wing reported three distinct groups defined by social deficits which occur along the autism continuum, ranging in severity from severe to mild. The first group was labelled by Wing as "Aloof" and describes people who appear indifferent to others. The second group was referred to as "Passive" and referred to a group of individuals who did not make spontaneous social approaches but accept approaches and do not resist if others pull them into an activity. The third category, labelled "Active but Odd" referred to individuals who made social advances but in an odd, one-sided fashion (Wing, 1988).

Wing (1988), focusing on a group of 95 children from Camberwell in the United Kingdom, examined their histories before the age of seven and was able to divide them into the three subgroups. The largest group of children fell into the Aloof category with 58 children described as tending to ignore or actively avoid social or physical contact. These children often had no comprehension of use of language and had no pretend play skills and nearly all the children described engaged in repetitive motor movements and displayed sensory sensitivities. Most children in the group Wing described fell into the intellectually deficient range.

Twenty-one children fell into the Passive subgroup and 15 of these children were in the borderline-average intellectual range, had useful practical and self-care skills and had some language (Wing, 1988). These children displayed some repetitive behaviour and some copied the pretend play of other children. The final 16 children met the description for the Active-but-Odd subgroup. Nine of these children had IQs in the borderline-average range and had at least some functional language. They had marked repetitive speech and repetitive play including copying the actions of characters from television or

books (Wing, 1988). In some children in the subgroup, verbal IQ was higher than performance IQ and although they demonstrated a high level of speech, this was not reflected in their comprehension scores on the appropriate Wechsler subtest. The remaining seven children in this subgroup, however, scored poorly on intelligence scales falling into the intellectually deficient range, had few skills and very little speech even though they made inappropriate physical advances to others.

While Wing's proposed continuum has been widely accepted and researched, empirical studies have also presented an opposing argument: that autism is a distinct disorder from Asperger's Syndrome and presents with distinguishable characteristics and ability patterns. In 1994 the diagnostic criteria for the Pervasive Developmental Disorders were again revised for the now current edition of the DSM, the DSM-IV (American Psychiatric Association, 1994). This time the revision process focused on compatibility between diagnostic systems, in particular the DSM and the ICD; the nature of the apparent high-rates of false-positive cases based on DSM-III-R criteria; the justification for inclusion of other diagnostic categories in the DSM-IV, such as childhood disintegrative disorder, Asperger's Syndrome, and Rett's Disorder; and alternatives for the DSM-IV definition of autism (Volkmar, 1996; cited in Pelios & Lund, 2001).

The DSM-IV (APA, 1994) appears to acknowledge that previous classification systems did not provide an adequate diagnostic system for children who did not fit the classical criteria for autism, but presented with a set of behaviours that impacted on their ability to function in the same way as typical peers. While the deficits in social and communication skills and restricted interests remained primarily the same, the DSM-IV

introduced the concept of a triad of impairments: the stipulation that a delay or abnormal functioning in social interaction, language used for social communication and/or symbolic or imaginative play be present prior to the age of three years (see Appendix D).

As well as more clearly defining the diagnostic criteria for autistic disorder, the DSM-IV included diagnostic criteria for other related disorders including Rett's Disorder, which describes a group of children with seemingly normal development until approximately five months followed by a deceleration of head growth, loss of purposeful hand movements followed by the development of stereotyped hand movements, loss of social engagement, and impaired language development (see Appendix D). Childhood Disintegrative Disorder is also included under the umbrella of pervasive developmental disorders and appears to resemble autistic disorder quite closely except that in order to meet criteria for Childhood Disintegrative Disorder, a child needs to have shown normal development for the first two years followed by loss of acquired skills in at least two areas including language, play, bladder or bowel control, social or adaptive behaviours or motor skills before the age of 10 years.

Diagnosis and Classification of Asperger's Syndrome

At the same time that Kanner was publishing his findings on autism in the United States in 1943, in Vienna, Austria another clinician was simultaneously describing a similar syndrome, now called Asperger's Syndrome. Hans Asperger became a medical doctor in 1931 and stayed in Austria throughout his career. He therefore wrote all his accounts in German. Although Asperger's work was described in the first issue of the Journal of

Autism and Child Schizophrenia (van Krevelen, 1971), it remained virtually unknown outside German-speaking countries. As director of the University Children's Clinic in Vienna, he first described this syndrome in 1944 when he observed a group of children who appeared to have autism but were more able in their use of language and in their social interactions. These children had fluent speech and a desire to interact with other children. They were intensely preoccupied with certain subjects, were poorly coordinated and had trouble with intricate social skills (Moyes & Mareno, 2001).

Lorna Wing is recognised as having drawn the English-speaking medical community's attention to the existence of Asperger's Syndrome by summarising Asperger's observations and providing clinical illustrations in what became an extremely influential journal article (Wing, 1981). In this article, Wing published information on a pattern of behaviour that had been described by Asperger, and in 1991, Uta Frith published a translation of Asperger's paper. In 1981 Wing introduced the term "Asperger's Syndrome" to describe the individuals who had autistic symptoms but better language and more social skills than most individuals with autism. In further articles, Wing described the main clinical features of Asperger's Syndrome as lack of empathy, demonstrating naïve, inappropriate and one-sided interactions, little or no ability to form friendships, pedantic, repetitive speech, poor nonverbal communication, intense absorption in certain subjects, clumsy and ill-coordinated movements and odd postures (Burgoine & Wing, 1983: cited Attwood, 1998).

Although Asperger has been credited with identifying the disorder, researchers have recently found a paper written by a female Russian psychiatrist, G.E Ssucharewa, in

1926 describing behaviour similar to that which Asperger described in 1944 (Wolff, 1996). The paper, published in a German journal, described six boys with "schizoid personality disorder of childhood" and was probably the first paper on children with this pattern of behaviour (Wing, 2005). Wing concludes that even though the chances of history have associated Asperger with the syndrome rather than Ssucharewa, Asperger's obvious empathy with the children he wrote about and his understanding of the basic rules for interacting with and helping them cannot be faulted and increases the significance of his 1944 paper.

After Wing's initial discovery of Asperger's work, several papers and systematic studies of Asperger's Syndrome were published during the 1980s (eg, Tantam, 1988; Gillberg & Gillbert, 1989; Szatmari, Bartolucci & Bremner, 1989). However, but it was not until Asperger's original paper was translated by Frith in 1991 that Asperger's work became widely available to researchers, clinicians and families world-wide. It is important to note that it is less than 20 years since the first book in English on the topic of Asperger's Syndrome was published, and less than 15 years since its inclusion in formal diagnostic manuals that confer special education entitlements and inform the medical and mental health community at large (Baron-Cohen & Klin, 2006).

Asperger's Syndrome and the Pervasive Developmental Disorders

Today Asperger's Syndrome is recognised as a common subgroup forming part of the Pervasive Developmental Disorders, introduced for the first time in the DSM-IV (APA, 1994) under the heading of "Pervasive Developmental Disorders" together with Autistic Disorder. It was also recognised in the ICD-10 in 1993 (WHO). In both these

classification systems there are marked similarities between the criteria for schizoid and schizotypal personality disorders and Asperger's descriptions (Wolff, 1995, 1996; cited in Wing 2005). Certainly, before the publication of the latest edition of the DSM and ICD, individuals with symptoms similar to that which Asperger described would in all likelihood have been diagnosed with schizoid personality disorder. Both disorders include preferring solitary activities, lacking close friends and failing to develop close relationships and it is easy to see how an individual with Asperger's Syndrome could be perceived as appearing detached and indifferent to others. The difference between the two disorders lies in the absence of non-verbal communication skills such as gestures and the presence of repetitive behaviours or restrictive interests in Asperger's Syndrome. The key feature of schizoid personality disorder is a profound lack of interest in social interaction and while the term was originally used to classify individuals with what we now know as Asperger's Syndrome, recent empirical data have shown that the two disorders can be differentiated. Individuals with Asperger's syndrome manifest multiple disorders of development, similar to autism, whereas schizoid personality disorder is limited to indifference to social interaction (Scheeringa, 2001).

Four distinctive sets of criteria are currently used to diagnose Asperger's Syndrome, two developed by clinicians, and two by organisations. The most restrictive and stringent criteria are provided by the World Health Organisation in their 10th edition of the *International Classification of Diseases* (ICD-10) and the American Psychiatric Association's fourth edition of the DSM (DSM-IV) (Attwood, 1998). The other two sets of criteria are less restrictive, these being criteria by Peter Szatmari and colleagues from Canada (1989) and Christopher and Corina Gillberg's Criteria for Asperger's Syndrome

from Sweden (1989). Appendix E outlines the diagnostic criteria for the four systems currently used to diagnose Asperger's Syndrome.

Differential Diagnosis of Asperger's Syndrome

When looking at the differences between the four sets of criteria, the widest discrepancy relates to the presence of a language delay in children diagnosed with Asperger's Syndrome. Both the DSM-IV (APA, 1994) and the ICD-10 (WHO, 1993) specify that in order for an individual to be diagnosed with Asperger's Syndrome, no language delay is to be present, whereas the Gillberg and Gillberg (1989) and Szatmari et al. (1989) criteria do not require typical language development (see Appendix E). Neither the DSM-IV (APA, 1994) nor the Szatmari et al. (1989) criteria include criteria relating to restricted interests. The ICD-10 does not make any reference to deficits in nonverbal communication, and the Gillberg and Gillberg (1989) criteria include motor clumsiness as a pre-requisite for diagnosis.

The DSM-IV and ICD-10 criteria both specify that there is to be no language delay in order for individuals to be diagnosed with Asperger's Syndrome, and yet many researchers have found this criterion highly questionable. Information regarding early development is often collected retrospectively and as a result developmental concerns or specific dates of milestones may not be remembered or may be perceived as significant and inflated leading to inaccurate and possibly unreliable information (Woodbury-Smith et al., 2005). While Asperger reported in his original paper that the early histories of the case he reported seemed to be normal, subsequent analysis did find that 25% of the patients he saw and diagnosed with "autistic psychopathy" had evidence of delay in

language and/or cognitive development (Hippler & Kliepera, 2003; cited in Woodbury-Smith et al., 2005).

There have been many reports of criteria being met for Asperger's Syndrome where there has indeed been language delay in the children diagnosed as such. A recent study of 100 males with Asperger's Syndrome utilised the diagnostic criteria of Gillberg and Gillberg to define the participant group (Cederlund & Gillberg, 2004). All 100 individuals also met diagnostic criteria for Asperger's Syndrome using the DSM-IV and ICD-10 criteria, except for the stipulation that language and cognitive development is not delayed in the first three years of life. Detailed data relating to early language development was available for 92 children in the study. From this information, 45 children clearly did not have typical language development at two years of age.

It is important to point out that the criteria used to diagnose Asperger's Syndrome in both the DSM-IV and ICO-10 are the least like Asperger's original descriptions (Wing, 2005). In particular, the diagnostic criteria do not include the presence of motor clumsiness as observed by Asperger in 1944. There is also no emphasis on the pragmatic aspects of language such as unusual prosody, formal or pedantic speech or peculiar voice characteristics as described by Asperger, (Wing, 1981; Gillberg, 1989). Instead, the criteria emphasise age-appropriate development up to three years of age in terms of language, self-help skills and curiosity, which can be difficult to ascertain. The criteria created by Gillberg and Gillberg (1989) were based on the descriptions of cases provided by Asperger resulting in a more comprehensive description of behaviours.

Impairments in pragmatic communication are considered to be a significant indicator of Asperger's Syndrome and may assist in making the distinction between Asperger's Syndrome, autism and other disorders of social interaction. Referring to the previous discussion of the similarities between DSM-IV and ICD-10 diagnostic criteria for Asperger's Syndrome and Schizoid Personality Disorder, the pragmatic communication difficulties described by Asperger may be a key indicator to delineate between the disorders but it is only described as a criterion in the Gillberg and Gillberg (1989) and the Szatmari et al. Criteria (1989).

In an attempt to address the criticisms given to both the DSM-IV and ICD-10 criteria for Asperger's Syndrome, Leekam et al. (2000) attempted to apply these criteria precisely to 200 children and adults. This resulted in diagnosis being made in only three cases, whereas when criteria like Asperger's own descriptions were applied, diagnosis was made in nearly half the group.

Diagnosis and Research into Asperger's Syndrome

In the period from Wing's first paper relating to Asperger's Syndrome in 1981 until 1993, only 50 papers had been published researching the disorder. Reviews of existing studies have been complicated by current confusion over diagnostic criteria with the different criteria applied in order to diagnose and assign cases to groups, making it difficult to compare and interpret the meaning of results across studies (Ozonoff et al., 1991). This factor has also made it difficult to compare research in order to determine aetiology and more importantly prevalence rates as the rates of diagnosis have been shown to vary significantly depending on the criterion used.

Debate Regarding Diagnosis – Continuity Vs Discontinuity

There has been considerable debate in the literature in relation to the diagnosis of autism and Asperger's Syndrome. There appears to be two main schools of thought. The first argues that autism and Asperger's Syndrome are distinct entities that can be validly distinguished from each other and individuals can be reliably categorised into two groups. The second proposes that the two disorders vary only in severity along a "dimension from the least to most socially withdrawn and non-communicative" (Manjiviona & Prior, 1999; p.327). Currently Asperger's Syndrome is often conceptualised as a variant of High-Functioning Autism and especially before the publication of the ICD-10 (WHO, 1993) and the DSM-IV (APA, 1994) the terms were used interchangeably. Although Asperger considered his syndrome to be different from Kanner's autism, Wing, with her vast clinical and epidemiological experience, has always considered Asperger's Syndrome to be part of the autism spectrum, a group of disorders including autism and Asperger's Syndrome with similar characteristics (Wing, 2005). Her argument for doing so relies on the idea that Asperger's Syndrome shares the impairments of social interaction, social communication and social imagination, as well as the repetitive pattern of activities and interests that characterise individuals with autism and Asperger's Syndrome.

Wing also observed that some children who fit the criteria for classic autism in their early years develop behaviour like Asperger described as they grow older, thus providing evidence for a continuum rather than the presence of separate and distinctive syndromes (Wing, 2005). In 1985, Gillberg as well as Volkmar, Paul and Cohen concurred that there was insufficient evidence at the time to consider High-Functioning

Autism and Asperger's Syndrome as separate disorders. However, by 1992, with more research and closer examination of the diagnostic groups, Gillberg had made the observation that expressive language at the formal level is usually better developed in Asperger's Syndrome and that motor skills are relatively better in autism concluding that perhaps the two disorders do not exist on a continuum but are in fact distinct disorders (Gillberg, 1992).

Research has continued over the past decade in order to determine whether there is a continuum of pervasive developmental disorders or if, in fact, Asperger's Syndrome is a disorder distinct from autism. In particular, research appears to have focused on differentiating between High-Functioning Autism and Asperger's Syndrome and finding qualities or measures which may separate the two disorders. One area which has attracted a great deal of interest is IQ and whether intelligence profiles can be used to differentiate between Asperger's Syndrome and High-Functioning Autism.

The term High-Functioning Autism is generally accepted as meaning individuals who meet criteria for autistic disorder but do not have an intellectual disability with a full scale IQ of 70 or more (Ghaziuddin & Mountain-Kimchi, 2004). For some practitioners, Asperger's Syndrome is seen to represent autism in individuals with high IQ or, specifically, autism associated with good or excellent verbal abilities (Cederlund & Gillberg, 2004). It is interesting to note that the clinical diagnosis of autistic disorder is almost never made in individuals with a full scale IQ of 100 or more (Gillberg, 2002; cited Cederlund & Gillberg, 2004). It appears differences in IQ scores can provide an arbitrary separation of cases.

Debate in the literature has been present for many years as to whether some kind of intellectual functioning should be included as a diagnostic criterion for Autism Spectrum Disorders including Asperger's Syndrome. While the DSM classification system has agreed that cognitive functioning is not crucial for diagnosis, it is important that any degree of intellectual disability be included as part of a diagnosis (Waterhouse et al., 1992). It has been argued that there are two subgroups of autism based on IQ, with a FSIQ of 70 considered to be the delineation between the two subgroups which exist within the diagnosis of autistic disorder, high-functioning and low-functioning. However, if IQ is understood to be a continuum of cognitive functioning then expressing this against a relatively fixed set of behavioural characteristics in autism and pervasive developmental disorders, it was argued that intellectual ability be coded separately.

Waterhouse et al. (1996) identified two groups within the autism spectrum, the first labelled the "'core autism'" group are identified by a high symptom count/lower IQ profile and featured individuals with stereotyped motor movements and sensory abnormalities with significantly impaired language comprehension, and impaired social imitation. The second group is distinguished by lower symptom count/higher IQ group, as well as the presence of speech with bizarre features and impaired prosody and the presence of perseverative behaviours. It was argued that because of the significant behavioural overlap it may be difficult to form clinical criteria to separate the two subgroups.

In one study of 95 children meeting criteria for an Autism Spectrum Disorder, only 3% of cases were found to demonstrate cognitive skills in the normal range with an IQ of 70

or above (Wing, 1998). It may be that a diagnosis is not always made in children with average intelligence. In cases where children are of borderline or average intelligence, there are more likely to be disagreements over diagnosis since the autistic features may be present but in less obvious forms. It is possible, for example, for such a child to be viewed by some as being impaired in social interaction, by others as having developmental language impairment or as having some form of semantic-pragmatic language disorder or even seen by others as a clumsy child (Wing, 1998).

Part of the difficulty in creating diagnostic criteria for both Asperger's Syndrome and autism has been the fact that neither Asperger nor Kanner were explicit in terms of what characteristics designate "caseness" and as a result, researchers are still attempting to determine accurate criteria that can be easily measured and replicated (Woodbury-Smith, Klin & Volkmar, 2005).

Implications for diagnosis and directions for future research

As well as having a heavily documented history of attempts to categorise and define autism, there have been numerous studies of theories relating to the aetiology of the disorder. At this point, no one individual factor can be attributed to the presence of autism and most likely there will be multiple indicators found to conclusively relate to the development of the disorder. In researching autism, there have been no findings to date which identify any deficit in cognitive or neural functioning, shared behavioural pattern or response to pharmacological intervention which is common to all individuals. Waterhouse, Wing and Fein (1989; cited Pelios & Lund, 2001) reported that studies

typically find that only a small percentage (10%-40%) of diagnosed individuals in their samples exhibit any one particular marker which might identify a causal link.

Wing (1988) reported that "knowledge of causes and their physical effects provides the most reliable foundation for diagnostic criteria but, in most psychiatric conditions, including autism, details of aetiology and pathology are still unknown" (p.91). Without a strong basis in aetiology, the diagnostic criteria have proven to lack the sufficiency required to generate valid and consistent diagnoses. One of the problems associated with unclear diagnostic criteria and no clear set of behaviours and symptoms which conclusively identify an individual as falling within the autism spectrum is that diagnosis can be delayed. Numerous cases have been reported of parents expressing concern with their child's delay in speech or unusual behaviours only to be told they are being overly concerned, the child is "'badly behaved'" and the parents need training, the child's development was delayed but they would "'catch up'", or that there are many other children who did not speak at the child's age but started speaking in full-sentences a short time later (O'Reilly & Smith, 2008). For many parents, many months, even years are spent pursuing a diagnosis for their child and valuable intervention time is lost. Almost universally, parents agree that if their child has an Autism Spectrum Disorder, then it is better to learn about it as soon as possible (O'Reilly & Smith, 2008).

With improved screening tools and rating scales, children can now be diagnosed as early as 18 months to 24 months with intervention able to commence immediately following a diagnosis or even if a diagnosis is suspected. For the subgroup of children with autism who have no identified central nervous system abnormalities, activation of correct neural

pathways to produce normative brain development would be possible if intervention starts early (Niemann, 1996; cited Pelios & Lund, 2001). With the knowledge that the brain exhibits a great deal of plasticity in the first few years of life, waiting to implement remedial techniques until the child is five or six years old may be too late. There is also evidence that children who begin intensive intervention before the age of three respond faster than children who begin after the age of five (O'Reilly & Smith, 2008).

Current prevalence rates have indicated that Pervasive Developmental Disorders are quite significant, affecting a high proportion of families around the world. The Australian Advisory Board on Autism Spectrum Disorders commissioned a report in 2007 to determine the prevalence of the disorder. The report found an estimated prevalence of Autism and Asperger's Syndrome across Australia of 6.5 per 10,000 for six- to 12-year-old children, in other words one diagnosis in every 160 children (Macdermott et al., 2007). Prevalence studies suggest that even though making a reliable diagnosis is difficult for clinicians using current criteria, the rate of diagnosis of autism and Asperger's Syndrome is continuing to increase.

The contradictions in the literature have made it extremely difficult for clinicians to make firm diagnoses, especially for children with Asperger's Syndrome. The possibility that the two disorders may have distinct functional profiles has implications for more confident processes for diagnosis and thus for future intervention programs. It will be important to look at methods to create clearer diagnostic criteria in order to produce reliable differential diagnosis particularly between children with autism and Asperger's Syndrome. To do this, future research needs to focus on finding indicators that can

objectively separate the two disorders or conclusively argue that autism and Asperger's Syndrome cannot be differentially diagnosed based on their symptom profiles.

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Empirical Study

Cognitive and Behavioural Profiles of Autism and Asperger's Syndrome: Are they Distinctive?

Cassandra le Fevre

Abstract

Cognitive and behavioural profiles were compared in children diagnosed as having either autism or Asperger's Syndrome, with the aim of investigating whether Asperger's Syndrome and autism constitute diagnostically separate syndromes, rather than existing on a continuum of diagnosis, one being a more or less severe manifestation of the other. A total of 26 children aged between 5 and 13 years and classified into two groups according to current diagnostic criteria, were assessed using the WISC-III (Wechsler, 1991) and the ABLLS protocol (Partington & Sundberg, 1998), a curriculum and skills tracking system designed to measure adaptive behaviours. Compared to the Autism group, the Asperger's Syndrome group presented with a higher level of cognitive and adaptive behavioural functioning, both at a global and subtest level. Supporting the idea of the disorders existing on a continuum, there were very few significant within-groups differences as hypothesised to show distinctive profiles. This finding coupled with significant and substantial between-groups differences, including nearly all the WISC-III and ABLLS measures, indicated two groups of children who are quantitatively different both on cognitive measures and adaptive skills, but are not qualitatively different in terms of having highly differentiated and individual patterns of adaptive behaviours and cognitive strengths and weaknesses. As well, discriminant function analyses using WISC_III and ABLLS measures as discriminating variables, revealed that only a minority of cases in the present sample were reliably classified according to a two-group function reflective of the Asperger's Syndrome/autism dichotomy, adding further credence to a continuity stance for the two disorders.

Autism, or Autistic Disorder as it is classified in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association, 1994), is a pervasive developmental disorder characterised by deficits in communication, play and social skills. Individuals meeting the criteria for autism are often described as being aloof and withdrawn, and demonstrate a desire for routine and the need to engage in repetitive behaviours.

Autism was first described by Leo Kanner in 1943. The term autistic comes from the Greek word "autos" and means an absorption in the self or subjective mental activity. Kanner applied this term to children who presented with an inability to relate to people and situations from the beginning of life. He also described communication deficits, good but atypical cognitive potential and behavioural problems such as obsessiveness, repetitious actions and unimaginative play (Wicks-Nelson & Israel, 1997).

Kanner listed five criteria defining the syndrome: 1) profound lack of affective contact; 2) anxious desire for the preservation of sameness; 3) fascination with objects that are handled with skill; 4) mutism or language that does not serve interpersonal communication; and 5) good cognitive potential shown by feats of memory, or skills on performance tests (Wing, 1988).

Around the same time as Kanner's work was being published in the United States, another clinician in Vienna, Austria was simultaneously describing a similar syndrome, now called Asperger's Syndrome. Hans Asperger, a medical doctor whose accounts

were written in German, first described this syndrome in 1944 when he observed a group of children who appeared to have autism but were more able in their use of language and in their social interactions. These children had fluent speech and a desire to interact with other children. They were intensely preoccupied with certain subjects, were poorly coordinated and had trouble with intricate social skills (Moyes & Moreno, 2001). Asperger's work was relatively unknown to the Western world until his accounts were summarised by Lorna Wing in 1981 and his original paper was translated in 1991 by Uta Frith.

Wing described the main clinical features of Asperger's Syndrome as lack of empathy, demonstrating naïve, inappropriate and one-sided interactions, little or no ability to form friendships, pedantic, repetitive speech, poor non-verbal communication, intense absorption in certain subjects, clumsy and ill coordinated movements and odd postures (Burgoine & Wing, 1983: cited Attwood, 1998).

Autism was originally classified as Schizophrenia, Childhood Type before being recognised as a distinct disorder in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III) in 1980 (APA, 1980). Asperger's Syndrome was first included in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) much later in 2004 (APA, 2004). The current version of the DSM includes Autistic Disorder, Asperger's Syndrome, Rhett's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorder – Not Otherwise Specified, which form the Pervasive Developmental Disorders (DSM-IV, APA, 1994). The *International Classification of Diseases*, 10th Edition, (ICD-10, 1992) also includes

criteria similar to the DSM-IV for both Autism and Asperger's Syndrome. See Appendix D and E for current diagnostic criteria for autism and Asperger's Syndrome.

Since the introduction of Asperger's Syndrome in 1981, the literature has been filled with contention in relation to whether autism and Asperger's Syndrome are in fact two distinct conditions warranting two separate sets of diagnostic criteria; or if they form part of a continuum sharing the same impairments, but with differing degrees of deficit. The diagnostic history of the two disorders suggests that they are separate syndromes and the DSM and other diagnostic systems treat the two syndromes as distinctive. Yet Wing (2005), who published the first paper in English on Asperger's Syndrome, has always considered the disorder to be part of the 'autistic spectrum'. Frith, who translated Asperger's original paper in 1991 also reported that the "prevailing view is that Asperger's Syndrome is not an essentially different disorder from autism, but a variant of autism, and located at the milder end of the spectrum of autistic disorders" (2004, p. 675).

Given that Asperger's Syndrome is a relatively new disorder and the body of research pertaining to the syndrome spans less than 30 years in English-speaking countries, it is understandable how the descriptions and criteria defining the disorder are continuing to evolve. There are currently four sets of criteria utilised in diagnosing Asperger's Syndrome, two developed by clinicians, two by organisations. The most restrictive and stringent criteria are provided by the World Health Organisation in their 10th edition of the ICD-10and the American Psychiatric Association's DSM-IV (Attwood, 1998). The other two sets of criteria are less restrictive, these being criteria by Peter Szatmari and

colleagues from Canada (1989) and Christopher and Corina Gillberg's Criteria for Asperger's Syndrome from Sweden (1989).

When looking at the differences between the four sets of criteria, the most marked discrepancy relates to the presence of a language delay in children diagnosed with Asperger's Syndrome. Both the DSM-IV (APA, 1994) and the ICD-10 (WHO, 1993) specify that in order for an individual to be diagnosed with Asperger's Syndrome, no language delay is to be present, whereas the Gillberg and Gillberg (1989) criteria as well as Szatmari et al.'s (1989) criteria do not require typical language development. Neither the DSM-IV nor the Szatmari et al. Criteria include restricted interests. The ICD-10 does not make any reference to deficits in non-verbal communication, and the Gillberg and Gillberg Criteria include motor clumsiness as a pre-requisite for diagnosis.

The criteria created by Gillberg and Gillberg (1989) were based on the descriptions of cases provided by Asperger resulting in a more comprehensive description of behaviours. These criteria are favoured by clinicians since they are clear, concise and comprehensive and do not prevent diagnosis if an individual has demonstrated a clinically significant delay in spoken or receptive language, a criticism of the DSM-IV and ICD-10 criteria (Attwood, 1998).

The findings of these studies are summarised below under separate subheadings outlining the different types of behaviour that have been investigated in an attempt to isolate and objectively quantify differences between the two syndromes. Clinical features that have been studied to distinguish Asperger's Syndrome with High-

Functioning Autism include motor clumsiness, pedantic speech, cognitive factors and outcome (Ghaziuddin & Mountain-Kimchi, 2004). Thus far results have been inconclusive and quite often conflicting. At times the terms High-Functioning Autism and Asperger's Syndrome have been used interchangeably. Cashin (2006) reported several papers documenting research in relation to Asperger's Syndrome where the term 'autism' was used in place of Asperger's Syndrome throughout the paper (Bowler, Matthews & Gardiner, 1997; Emerich, Creaghead, Grether, Murray & Grasha, 2003; Losh & Capps, 2003; McAlonan et al., 2002, in Cashin, 2006).

When examining the diagnostic criteria for both autism and Asperger's Syndrome, there is considerable overlap. Using the DSM-IV (1994) criteria, both disorders contain identical criteria requiring impairments in social interaction and patterns of restricted repetitive and stereotyped behaviour in order to make a diagnosis (see Appendix D and E). The only difference in diagnosis appears to be an apparent arbitrary delineation between the two disorders based on the presence or absence of previous language and cognitive delay. The DSM-IV (APA, 1994) stipulates that individuals with Asperger's Syndrome cannot present with evidence of a clinically significant language or cognitive delay before the age of three years and their adaptive behaviour and self-help skills, apart from social interaction, should not be delayed. This means that the only way individuals are diagnosed with Asperger's Syndrome, and not autism, is based on generally retrospective and possibly unreliable parental reports of language development.

The Gillberg and Gillberg Criteria for Asperger's Syndrome (1989) also include impairment in social interaction as one of its diagnostic criteria, however the items are more operationally defined with a distinction between inability and lack of desire to interact with peers, as well as provision for socially and emotionally inappropriate behaviour. Instead of stipulating that in order to meet diagnosis no language delay should be present, the Gillberg and Gillberg Criteria include a set of measures relating to language. Three of these items should be observable in the individual including the presence of a language delay, formal and pedantic language, odd prosody and impairment in comprehension. Impairment in non-verbal communication is a required criterion where this is not the case for a diagnosis of Autistic Disorder in the DSM-IV (APA, 1994). The Gillberg and Gillberg Criteria also specify that individuals need to demonstrate motor clumsiness, a marker distinguishing them from the characteristics of autism. In order to receive a diagnosis of Asperger's Syndrome using Gillberg and Gillberg's Criteria, individuals also need to demonstrate some form of stereotyped or repetitive behaviours. However, children with Asperger's Syndrome have been shown to exhibit fewer repetitive behaviours but more abnormal preoccupations, all absorbing narrow interests, and higher rates of motor problems (clumsiness, manual speed, coordination and balance problems) and anxiety when compared to individuals with autism (Gillberg, 1989; Klin & Volkmar, 1997; Szatmari, Bartolucci, & Bremner, 1989, cited in Macintosh & Dissanayake, 2004).

Consensus has not yet been reached in terms of the specific behaviours which need to be consistently observed in order to clearly identify Asperger's Syndrome and those markers which separate this disorder from other Pervasive Developmental Disorders

including autism. Numerous studies have been conducted in order to compare individuals with a diagnosis of autism (in particular High-Functioning Autism) and Asperger's Syndrome. Comparisons have examined language and communication differences, motor differences, social behaviour, cognitive differences and level of restricted and repetitive rituals and interests; in order to determine whether or not the two disorders actually exist on the same continuum or if they have distinctive profiles.

Motor Differences between Autism and Asperger's Syndrome

Motor clumsiness has recently been proposed as a feature which may reliably distinguish Asperger's Syndrome from High-Functioning Autism. Gillberg (1989) used a standardised instrument to compare gross motor clumsiness between the two groups and found there was more prevalence among individuals with Asperger's Syndrome. A subsequent study compared individuals with autism and Asperger's Syndrome matched on Verbal Intelligence Quotient (VIQ) and Performance Intelligence Quotient (PIQ), using scores on a standardised measure of upper limb coordination as well as gross and fine motor capabilities. The groups were found to be similar to each other in all three areas (Ghaziuddin et al., 1994; Ghaziuddin & Butler, 1998). Other studies have also found no difference between motor abilities of participants with autism and Asperger's Syndrome (Manjiviona & Prior, 1995; Miller & Ozonoff, 2000), however Klin et al. (1995) reviewed the chart records of individuals with autism and Asperger's Syndrome and found the latter to be more likely to have a history of fine and gross motor difficulties.

While studies have shown mixed outcomes, it is important to recognise that clumsiness itself is a difficult concept to define and measure and studies examining the differences between the two groups are difficult to compare (Ghaziuddin et al., 1994).

When examining developmental history, in particular motor milestones, in groups of children with autism and Asperger's Syndrome, several studies have found the two groups to be similar in regard to early motor development (Ghaziuddin et al., 1992; Szatmari et al., 1995; Eisenmajer et al., 1996; Howlin, 2003). The studies all relied on parental report to determine early motor development levels, however the study by Eisenmajer and colleagues (1996) met with criticism as all the children in the Asperger's Syndrome group also met criteria for autism (Macintosh & Dissanayake, 2004).

Differences in Language Development

Children with autism often show higher rates of speech delay and deviant language than children with Asperger's Syndrome including delayed echolalia, pronoun reversal, unusual intonation, little or no reciprocal verbal exchange, and use of neologisms (Verte, Geurts, Roeyers, Oosterlaan & Sergeant, 2006). Fine, Bartolucci, Ginsberg and Szatmari (1994) have conducted a series of studies examining the difference in communication abilities between individuals with High-Functioning Autism and Asperger's Syndrome. Comparing the two groups, participants with High-Functioning Autism were found to use less intonation in conversation (1991), more use of pronoun reversal and echolalia (1989), and made fewer links to previous details given in conversation (1994). These authors also found no difference in parental reports in relation to the frequency of repetitive speech, speech initiation, and the understanding of nonverbal communication such as gestures (1989). Gillberg (1989) found that

individuals with autism demonstrated more odd vocal pitch. It is important to note that the previously mentioned studies were all conducted prior to 1994, before the development of formalised diagnostic criteria for Asperger's Syndrome and therefore, non-standardised diagnoses were conducted (Macintosh & Dissanayake, 2004).

Social Behavioural Differences

When examining markers which may differentiate between autism and Asperger's Syndrome, social behaviour is one area that has perhaps been under-utilised in terms of research. A recent review of the literature by Matson and Wilkins (2008) revealed several empirical differences between Asperger's Syndrome and High-Functioning Autism including less social impairment in individuals with Asperger's Syndrome (eg, Szatmari et al., 1989; Szatmari et al., 2000, cited in Matson & Wilkins, 2008). When compared to individuals with High-Functioning Autism, individuals with Asperger's Syndrome appear to present with more problems in social relationships (Tonge et al., 1999, cited in Matson & Wilkins, 2008), less social phobia (Klin et al., 2005, cited in Matson & Wilkins, 2008) and more interpersonal mishaps (Pituch et al., 2007, cited in Matson & Wilkins, 2008).

Using structured parent interviews, Szatmari et al. (1995) found that children with Asperger's Syndrome aged between four and six years were reported as showing a higher rate of social intention, social reciprocity, greetings, affection and comfort seeking, as well as demonstrating more pleasure or excitement in social interactions when compared to children with autism. No difference, however, was found in terms of participation in conversation, gestures, imitation, appropriate use of facial expressions,

the existence of friendships or engagement in shared activities in comparison to children with autism.

In a review of the literature by Macintosh and Dissanayake (2004), several studies were used to illustrate a finding which indicates that the two conditions may become more similar over time. When comparing social competences, it appears that the differences become less pronounced with increasing age. For example; when examining the level of social competence and reciprocal social interaction in children with autism compared to those with Asperger's Syndrome, Ozoznoff et al. (2000) found that children with Asperger's Syndrome demonstrated fewer deficits between the ages of four and five years. This information was obtained retrospectively using parental report and at the time of testing, when the participants were aged between six and 21 years old, the reported differences were no longer present nor could the groups be differentiated on levels of social interaction when observed in a clinical setting. The reliability of parental reports, some of which were of observations and information dating back 15 years, could be questioned; however similar results were found by Gilchrist et al. (2001).

When comparing imitation skills in social play, greetings, attention and help-seeking behaviours, children with Asperger's Syndrome demonstrated fewer deficits than individuals with High-Functioning Autism (Gilchrist et al., 2001; cited in Macintosh & Dissanayake, 2004). Once again, based on parental report, these differences were no longer present at adolescence. Observational data taken from a clinical setting revealed no significant differences in social interaction apart from the level of conversational

skills with adolescents with Asperger's Syndrome engaging in conversation more frequently than those with autism.

One proposed difference between Asperger's Syndrome and autism is that the desire for friendship is stronger for individuals with Asperger's Syndrome. Macintosh and Dissanayake (2004) reported that Asperger's Syndrome "may be associated with a stronger desire for friendship and a greater ability to engage in prosocial behaviours than High-Functioning Autism, but not necessarily a superior capacity for forming and maintaining friendships" (p.430).

IQ Differences between Autism and Asperger's Syndrome

Since autism was first included as a separate disorder in the DSM-III in 1980, debate has ensued about the relationship between autism and intellectual impairment and whether or not intelligence should be added as a criterion in order to diagnose autism. When creating the DSM-III-R, it was decided that while understanding an individual's level of cognitive functioning was important, it was not essential for a diagnosis of autism. The advisory committee decided that there would be "no minimal cutoff IQ for diagnosing autism or PDD-NOS" (Waterhouse et al., 1992, p. 543). Based on the information being presented in empirical studies, however, IQ may be an important factor in determining whether or not autism and Asperger's Syndrome are distinct disorders.

In terms of profile analysis, there are very few published studies examining the cognitive profiles of children with autism and/or Asperger's Syndrome. One of Kanner's original five defining criteria specified that individuals demonstrated "good cognitive potential

shown by feats of memory, or skills on performance tests" (Wing, 1988). In Wing and Gould's 1979 study which included all children with disabilities in an area of London, the authors found 20 per 10,000 children with any features of autistic behaviour presented with IQs below 70. When Asperger (1944) presented the findings on his original group of four children with a variety of social and emotional difficulties, he did not provide details on standardised tests of intelligence nor did he comment on the difference between VIQ and PIQ (Ghaziuddin & Mountain-Kimchi, 2004). However, according to Frith's translation of Asperger's paper in 1981, Asperger believed that his patients were gifted, having high intelligence.

The Wechsler Intelligence Scales have commonly been used to investigate the differences in cognitive profiles of individuals with autism and Asperger's Syndrome. It is important to note that both within- and between-groups differences have been contrasted and compared in order to evaluate the distinctiveness of the two syndromes. Similarities have been found in the literature when comparing global intelligence measures provided by the Wechsler Intelligence Scales, namely Verbal Intelligence Quotient (VIQ), Performance Intelligence Quotient (PIQ) and Full Scale Intelligence Quotient (FSIQ).

It has been suggested that children with Asperger's Syndrome are likely to have a higher VIQ than PIQ, a pattern that is generally the opposite from that in children with autism (Klin et al., 1995). This difference in global intelligence measures is indicative of a discontinuous model, with autism and Asperger's Syndrome presenting with opposing profiles. Studies involving individuals with Asperger's Syndrome have consistently

reported significantly higher VIQ when compared to PIQ and higher VIQ when compared to individuals with autism. The same VIQ-PIQ difference is not seen in autism samples, generally no significant differences between the two global measures have been found (Klin et al., 1995).

Koyama et al. (2007), Manjiviona and Prior (1999) and Ghaziuddin et al. (1994) did not find significant differences between VIQ and PIQ in the High-Functioning Autism group, however Koyama et al. did report individuals with autism demonstrating higher PIQ than VIQ, whereas VIQ tended to be higher than PIQ in individuals with Asperger's Syndrome, again supporting the idea of distinct and separate disorders each with their own cognitive profiles. Ghaziuddin and Mountain-Kimchi (2004) suggest that as a group, the children with Asperger's Syndrome show a significant VIQ-PIQ discrepancy with 82% of the sample presenting with a higher VIQ than PIQ. Nonetheless, there were several participants who demonstrated the reverse trend with scores typical of the autism group. The researchers did not indicate if these differences were significant in all cases.

On the other hand, studies have generally shown that individuals with Asperger's Syndrome outperform individuals with autism or High-Functioning Autism in VIQ and FSIQ scores indicating that the two disorders are essentially the same with Asperger's Syndrome presenting as a less severe manifestation of autism. Koyama et al. (2007) found individuals with Asperger's Syndrome demonstrated significantly higher VIQ than individuals with High-Functioning Autism. This finding was endorsed by research carried out by Ghaziuddin and Mountain-Kimchi (2004), Ozonoff et al. (1991), Gilchrist et al. (2001; cited in Macintosh & Dissanayake, 2004) and Manjiviona and Prior (1999).

Ghaziuddin and Mountain-Kimchi also found that individuals with Asperger's Syndrome demonstrated a higher mean FSIQ score compared to the High-Functioning Autism group, as did Gilchrist et al. and Manjiviona and Prior, but no significant differences were found between the two groups on PIQ. From this research, it appears that the cognitive profiles are similar with Asperger's Syndrome merely representing a higher functioning version of autism.

Subtest Profile Differences between Autism and Asperger's Syndrome

When comparing individual subtest profile differences using the Wechsler tests of intelligence, research has shown mixed results in terms of providing evidence for continuity or discontinuity in the two syndromes. Individuals with autism have consistently demonstrated strengths in the performance subtests of Block Design and Object Assembly and weaknesses in the verbal subtests, particularly Comprehension and Vocabulary. Even though there has been an increase in the reporting of cases of Asperger's Syndrome in the literature, there is yet to be consensus in terms of cognitive profiles for this group of individuals. Current research examining the cognitive profiles of Asperger's Syndrome have demonstrated less consistent findings but have commonly presented with high scores in Information and Vocabulary subtests and low scores in Coding, Digit Span and Object Assembly (Cederlund & Gillberg, 2004; Ghaziuddin & Mountain-Kimchi, 2004; Manjiviona & Prior, 1999 & Ehlers et al., 1997).

In support of the discontinuity hypothesis, where autism and Asperger's Syndrome would present with distinctive cognitive profiles, several papers have identified differing peaks and troughs in subtest scores of the Wechsler Intelligence Scale for Children

(WISC) or Wechsler Adult Intelligence Scale (WAIS) assessments. Koyama et al. (2007) compared the cognitive profiles of individuals aged between five and 31 years diagnosed as High-Functioning Autism with those diagnosed as Asperger's Syndrome according to DSM-IV criteria (APA, 1994). All participants had FSIQ scores above 70. The Asperger's Syndrome group scored significantly higher on Comprehension and Vocabulary when compared with the High-Functioning Autism group but lower on the Coding subtest.

Ehlers, Nyden, Gillberg and Dahlgren-Sandberg (1997) compared the profiles of children with Asperger's Syndrome, Autism and Attention Disorders using the Swedish version of the WISC-R. Each sample group contained 40 children aged five to 15 years and results demonstrated clear profiles in each group. The Asperger's Syndrome sample showed peaks in Comprehension and Vocabulary and troughs in Object Assembly and Coding. Individuals with High-Functioning Autism showed a peak in Block Design.

Ghaziuddin and Mountain-Kimchi (2004) compared groups of children with autism and Asperger's Syndrome using the WISC (1992) or the WAIS-R (1997). All participants met the strict DSM-IV criteria for either autism or Asperger's Syndrome and had a full-scale IQ above 70. Participants in the Asperger's Syndrome group were excluded if they met criteria for autism or who had been diagnosed with autism in the past. Subjects with Asperger's Syndrome performed better than those with High-Functioning Autism on Information, Vocabulary and Arithmetic subtests. The two groups did not differ significantly on scores for the Block Design and Object Assembly tasks. Participants in

the Asperger's Syndrome group scored highest on the Information subtest, whereas those in the High-Functioning Autism group scored the highest on Block Design

Other studies have presented results supporting continuity between the disorders. Ozonoff, South and Miller (2000) compared 23 children with High-Functioning Autism with 12 children meeting the DSM-IV criteria for Asperger's Syndrome. A group of 27 controls were matched with the autism and Asperger's Syndrome samples in terms of their chronological age and intellectual ability. Among other measures, the WISC-III was utilised to compare cognitive profiles. The two clinical groups did not differ from each other in terms of the peaks and troughs of their cognitive profiles. However, the Asperger's Syndrome group performed significantly better than the autism group in the Comprehension subtest and both the High-Functioning Autism and the Asperger's Syndrome groups performed significantly less well than the control group on the Coding subtest.

All participants demonstrated an IQ score in the average range or above which in itself may have restricted the sample in Ozonoff et al.'s (2000) study. The results only pertain to children in the average ability range, which limits the ability to generalise the findings across the autism spectrum. Research has shown that as many as 75% of children with autism have some level of intellectual deficiency (Lincoln et al., 1988), therefore these results are only indicative of 25% of the autistic population. More recent reports have estimated more conservatively with 50-60% of individuals with autism presenting with intellectual disabilities (Matson & Wilkins, 2008). Regardless of the figure, including only participants with IQs above 70 excludes at least 50% of the autism population and

indicates that if the population was more representative, perhaps more differences would be found.

In the only study using the Australian version of the WISC-R (Wechsler, 1974) and WAIS-R (Wechsler, 1981), Manjiviona and Prior (1999) completed a similar study but attempted to address the discrepancies in diagnosis with the presence or absence of language delay in Asperger's Syndrome. The researchers looked at the difference in cognitive profiles of children with Asperger's Syndrome diagnosed using strict DSM-IV criteria as opposed to those who did have a history of language delay. Out of 35 children diagnosed with Asperger's Syndrome, 21 satisfied DSM-IV/ICD-10 diagnostic criteria, where 14 children had a history of language delay. The group of 21 children with autism contained five children that also did not have a history of language delay.

Using the Wechsler Intelligence Scales to assess the cognitive profiles of these groups, Manjiviona and Prior (1999) found that there was no significant difference between the Asperger's Syndrome and autistic groups overall on Verbal and Performance subtests. There was also no significant difference found between children without language delay and children with a history of delayed language. Profiles of all groups were very similar with peaks in performance on Block Design. Relative dips in performance were found on the Digit Span task for children with Asperger's Syndrome, with or without language delay, whereas children with autism demonstrated their poorest performance on the arithmetic task. On the basis of these results, the presence or absence of a language delay does not appear to have any relationship to the neurocognitive profiles of children with Asperger's Syndrome. Manjiviona and Prior comment that while their

neurocognitive findings appear to support a spectrum view of autistic disorders, differential profiles could emerge with the comparison of lower than average IQs, as all children in the study had an IQ in the average or near-average range.

After reviewing the literature, it appears that for every research paper which identifies differing profiles, there is another paper which argues for the idea of an autism continuum with samples of individuals with autism and Asperger's Syndrome sharing similar peaks and troughs in subtests of WISC or WAIS subtests even if the level of functioning is variable. Whilst intelligence testing is a valid and empirically validated method for creating and comparing profiles of children with autism and Asperger's Syndrome, it does not necessarily address some of the most important deficits and differences in these disorders – behaviour. Cederlund and Gillberg (2004) reported that approximately half of the 100 males in their studies were in special education classrooms or were supported by an aide in a mainstream classroom in spite of having average or above-average IQ. This illustrates the degree of overall clinical impairment and the need to consider behavioural deficits when diagnosing individuals with autism and related disorders. It is important when assessing any differences between autism and Asperger's Syndrome that both cognitive and behavioural indicators are taken into account. An adaptive scale such as the Assessment of Language and Learning Skills (ABLLS; Partington & Sundberg, 1998) is one such measure that could be utilised to compare the behavioural skills of individuals with autism and Asperger's Syndrome.

Aims and Hypotheses

The principal aim of the present study was to investigate whether Asperger's Syndrome and autism constitute diagnostically separate syndromes, rather than existing on a continuum of diagnosis, one being a more or less severe manifestation of the other. If Asperger's Syndrome and autism are indeed distinctive and separate syndromes, they should exhibit reliable differences in terms of the signs and symptoms that ostensibly distinguish them one from the other. These differences are encapsulated in diagnostic criteria, which espouse a discontinuity stance; that Asperger's Syndrome and autism are indeed distinctive diagnostic categories. While the diagnostic criteria are not in themselves testable, hypotheses were generated from these criteria regarding the reliable differences that should exist in terms of the observable cognitive, psychosocial, and daily functioning of individuals in the two categories. Reliable differences established in key areas of functioning where they are expected, as well as an absence of differences where they are not expected, would provide both convergent and discriminant evidence for the construct-related validity of the dichotomous stance: that Asperger's Syndrome and autism are distinctive diagnostic categories.

In the present study, two groups of children diagnosed with each of these conditions by experienced diagnosticians using DSM-IV criteria for Autistic Disorder and Gillberg and Gillberg's Criteria (1989) for Asperger's Syndrome, were assessed using measures providing an operationalisation of the diagnostic criteria, namely the WISC-III providing cognitive measures and the Assessment of Basic Language and Learning Skills (ABLLS; Partington & Sundberg, 1998) providing adaptive functioning measures. These objective measures were compared statistically to determine

a) whether significant between-groups differences exist between the Autism and Asperger's Syndrome groups in crucial areas of functioning reflected by DSM-IV and Gillberg and Gillberg Criteria; and do not exist where they are *not* expected according to the diagnostic criteria

and

b) whether each group (Asperger's Syndrome and Autism) exhibit distinctive cognitive and adaptive behavioural profiles in terms of relative strengths and weaknesses that would be predicted by DSM-IV criteria.

The analytical approach thus consisted of both within- and between-groups analyses of WISC-III subtests and ABLLS subtests. Patterns of similarities and differences were analysed, with Cohen's *d* statistics used to establish whether any observed differences were large, medium or small, in terms of their magnitude.

Based on DSM-IV criteria it was expected that the following between-groups effects would be found: The Asperger's Syndrome group would demonstrate an overall higher level of functioning with both global measures of cognitive functioning and individual subtest scores on the WISC-III and the ABLLS being significantly higher than those scores for the Autism group.

Based on DSM-IV and Gillberg and Gillberg Criteria and consistencies in previous research, it was expected that the following within-groups effects would be found for the Autism group, demonstrating support for discontinuity between the syndromes.

According to the DSM-IV criteria, individuals with autism either present with delay in spoken language or marked impairment in their ability to initiate or sustain conversation. Therefore, the Autism group in the present study were expected to perform more poorly on the Verbal Subtests Comprehension and Vocabulary in the WISC-III assessment compared with overall Verbal performance, and would similarly demonstrate lower scores on the Labelling and Intraverbal subtests in the ABLLS compared with an aggregate performance on all ABLLS subscales. An "intraverbal" is defined by Skinner (1957) as a verbal response controlled by a verbal discriminative stimulus. In simple terms, those conversational skills requiring a verbal response to a verbal statement or question where the response is in a different form to the preceding verbalisation. For example, a person might ask a child "What is your name?" to which he may reply "John".

The Block Design subtest measures visual-perceptual ability, as well as spatial and non-verbal problem solving, and Object Assembly measures visual analysis skills and construction of a whole from its parts (Wechsler, 1991). Both these subtests are purely non-verbal and should theoretically not be affected by communication difficulties. For some children with autism who demonstrate persistent preoccupation with parts of objects, both these subtests may play to their strengths. Therefore based on diagnostic criteria and the results of previous research, it was hypothesised that the Autism group would display relative strengths in performance tasks, namely the Block Design and Object Assembly subtests of the WISC-III. This strength was also expected to be reflected in the ABLLS with higher scores in the Visual Performance subscale than the aggregate of ABLLS subscales. While previous research has demonstrated trends

toward PIQ being higher than VIQ in individuals with autism, studies have rarely found significant differences in measures of global intelligence. Therefore, the Autism group was not expected to demonstrate significant differences between VIQ and PIQ.

Consistent with a discontinuity stance for autism and Asperger's Syndrome, several within-groups effects were expected for the Asperger's Syndrome group in the present study: According to Gillberg and Gillberg's Criteria (1989) and in accordance with previous research, it was expected that the Asperger's Syndrome group would demonstrate higher scores in the verbal subtests of the WISC-III, in particular Information and Vocabulary, compared to an aggregate of verbal subtests. Both subtests reflect a child's language development and word knowledge and reflect a child's ability to process and retrieve information (Wechsler, 1991). It was also expected that a similar effect would also be seen in the Labelling and Intraverbal subtests in the ABLLS. While children meeting Gillberg and Gillberg's Criteria for Asperger's Syndrome may present with a language delay or have difficulty comprehending language, often the use of formal, pedantic language or superficially perfect expressive language would indicate a large vocabulary and ability to retain and recall general knowledge information. Based on previous research, it was expected that VIQ would also be higher than PIQ.

With evidence of poor motor skills and the requirement that individuals need to exhibit motor clumsiness in order to meet a diagnosis of Asperger's Syndrome, it was expected that this group in the present study would demonstrate relatively lower scores on the Coding and Object Assembly subtests on the WISC-III compared with an aggregate of Performance subtests, an effect reflected also in lower ABLLS scores on the Gross and

Fine Motor subtests compared with an ABLLS aggregate. The Asperger's Syndrome group was expected to score relatively lower in the Social Interaction subtest from the ABLLS as Gillberg and Gillberg's Criteria (1989) specify clear deficits in reciprocal social interaction. Lower scores on the Digit Span relative to other Verbal subtests from the WISC-III were predicted, based on previous research and the decreased ability for individuals with Asperger's Syndrome to concentrate and attend to verbal information.

A subsidiary aim of the present study was to identify which objective measures were the most efficacious discriminators of autism and Asperger's Syndrome, and most reliably classified individuals into the two groups. Identifying such discriminators may assist diagnosticians in making better diagnoses of children presenting with Autistic and Asperger's Syndrome symptomatology. Fisher's linear discriminant analysis using WISC-III IQ and combinations of ABLLS subscales as discriminant variables, and a two-group model (function) were therefore employed to classify children presenting with Autism/Asperger's Syndrome signs and symptoms. This analysis was intended to indicate the specific cognitive measures (WISC-III) and adaptive functioning measures (ABLLS), giving the most reliable classification of children. The relative discriminatory power of the different variables was determined by examining the relative sizes of the beta (standardised coefficients) in the structure matrices, the relative sizes of the eigenvalues and canonical correlations, the discriminant scores for classification of individuals and their probabilities, and finally, the tests of significance of the two-group function, using cognitive and adaptive behavioural measures as discriminators.

The final aim of the present study was to determine the consistency between the diagnostic classifications by experienced diagnosticians of children exhibiting Autism/Asperger's Syndrome signs and symptoms; and classifications of the same children made on the basis of objective cognitive and adaptive behavioural measures Thus the concurrent validity of using adaptive behavioural and cognitive measures as reliable, objective markers of Autism and Asperger's Syndrome was examined, with the classification of children as having Autism or Asperger's Syndrome by diagnostician used as the validity criterion. If a high degree of overlap was demonstrated between diagnostician-based classification of children exhibiting Autism/Asperger's Syndrome signs and symptoms, and classification of the same children based on objective cognitive and adaptive behavioural measures, it would provide strong validity evidence for the use of objective measures in diagnosis of Autism and Asperger's Syndrome. In the present study, Fisher's linear discriminant analyses first classified children according to a two-group function, based on a theoretically dichotomous diagnosis (Autism/Asperger's Syndrome), using ABLLS and WISC-III scores as the discriminators. A case-by-case analysis of the children indicated whether individual children were similarly or differently classified by the two approaches. Chi Square and Kappa statistics indicated the degree of overlap between the two types of classification. Highly significant Chi Square values and strong Kappa statistics would show high levels of agreement, and therefore would attest to the criterion-related validity of using objective cognitive and adaptive behavioural measures in the diagnosis of children presenting with Autism/Asperger's Syndrome signs and symptoms.

Method

Participants

A total of 27 children (25 males, 2 females) aged between 5 years, 1 month and 13 years, 8 months and diagnosed with Asperger's Syndrome (n=14) or Autism (n=13) participated in the study. The children were recruited from across Australia including Tasmania (n=11), Queensland (n=5) and New South Wales (n=11).

The average age of the children at the time of participation in the study was 106.69 months (SD= 28.18). The Autism group had a mean age of 94.93 months (SD=26.08) and the Asperger's Syndrome group produced a mean age of 121.58 months (SD=23.49).

To qualify for participation, children in the study were required to have been diagnosed by a trained clinician (psychologist, paediatrician or multi-disciplinary team) and to have been given a current diagnosis of Autism or to have met Gillberg and Gillberg's Criteria (1989) for Asperger's Syndrome. Children with additional diagnoses such as Attention Deficit Hyperactivity Disorder (ADHD) were excluded from the study, and were noted as ineligible on advertisements for the study. In addition, children who were diagnosed with Asperger's Syndrome using the Gillberg and Gillberg Criteria but who also met the DSM-IV criteria for a diagnosis of Autism were excluded. No exclusions based on diagnosis were required; the trained clinicians who provided the diagnosis for each participant ensured that children who met the criteria for Gillberg and Gillberg's Criteria (1989) for Asperger's Syndrome were well differentiated from the Autism group in

terms of their symptomatology. One child was excluded from the study as he no longer met criteria for Autism or Asperger's Syndrome after the assessment period had commenced.

Measures

The Wechsler Intelligence Scale for Children – III (WISC-III; Wechsler, 1991) was used in the present study with all 13 subtests administered. The study was initiated before the release of the WISC-IV (Wechsler, 2003), but data collection continued after the release of the WISC-IV. Although correlations between the two tests are relatively high (.89 for FSIQ), the differences in subtests and the elimination of the VIQ and PIQ scores in the WISC-IV prompted a decision to continue to use the WISC-III throughout the testing period in order to prevent the resulting data from being confounded.

In two cases, the Wechsler Preschool and Primary Scale of Intelligence – III (WPPSI-III; Wechsler, 2002) was used as it was not deemed to be ethical to administer the more difficult WISC-III for lower functioning children. One participant was unable to be assessed using either the WISC-III or WPPSI-III.

The Assessment of Basic Language and Learning Skills (The ABLLS; Partington & Sundberg, 1998) was also used as part of the assessment. According to the authors, the ABLLS is an assessment, curriculum guide and skills tracking system for children with language delays. It contains a task analysis of the many skills necessary to communicate effectively and to learn from everyday experiences. Based on Skinner's book *Verbal Behavior* (1957), the protocol contains twenty-five separate areas of learning including

visual performance, imitation, play, and social interaction as well as academic skills, self-help and motor skills. The ABLLS also separates language into five distinct categories which identify the different contexts individuals use language; receptive language, vocal imitation, requesting, labelling and intraverbals. By separating language into the different environmental conditions in which language occurs, the ABLLS is an important tool for identifying the specific language deficits experienced by many children with autism as well as point to areas most in need of intervention (Partington & Sundberg, 1998). Most importantly, the division of several types of language illustrates the importance of identifying and teaching language under all these different environmental contexts. See Appendix F for a full copy of the ABLLS Protocol.

The purpose of the ABLLS is to identify those language and other self-help and social behaviours that are in need of intervention in order for a child to become more capable of learning from his or her everyday experiences (Partington & Sundberg, 1998). The ABLLS can be likened to other adaptive behaviour scales such as the Vineland Scale as it measures behaviours such as cooperation, play skills, social interaction, group instruction, self- help skills such as dressing, eating, grooming and toileting as well as gross and fine motor skills. The assessment was developed and modified after being trialled using 100 children with language delays. Each subscale follows in approximate developmental sequence and items are scored from observation, parent interview and direct testing from a trained administrator. The items from each subscale can be assigned a score with maximum scores for each item ranging from one to four.

A score can be derived from each subscale item and is graphed on the assessment's *Skills Tracking System*, a graph which illustrates scores for each subscale and the areas of deficit within each behavioural skill being measured. No overall score is given; instead a child's progress can be measured in each subscale (developmental area) and tracked over time with reassessment encouraged every three months. To date there are no published studies outlining the validity and reliability of the ABLLS as an assessment tool. A standard set of materials was developed in order to ensure uniform testing across participants. All 26 participants successfully completed the ABLLS assessment.

Procedure

Ethics approval for the research project was granted by the Tasmanian Social Sciences Human Research Ethics Committee. Children were recruited for the study using advertisements placed in the newsletters of autism and Asperger's Syndrome support groups, at centres specialising in diagnosis and intervention services of autism and related disorders and through email distribution lists. Interested parents were asked to contact the investigator by phone or email and were then provided with an information sheet outlining the procedures of the study and a parental consent form was completed by parents or guardians before commencing the assessment sessions (see Appendix G and H). Families were under no obligation to participate in the assessment sessions and could withdraw without penalty after obtaining additional information pertaining to the study. They were also informed that they were able to withdraw their child from the study at any time.

Parents were advised before meeting with the assessor that the child's diagnosis was not to be discussed until after the assessments were completed, that it was imperative that the assessor did not know the specific diagnosis of the child. The assessor was not involved in the diagnostic process; any diagnostic assessment of the children was conducted by an independent clinician.

The assessments were conducted by the investigator who was trained in administration of the WISC-III and the ABLLS. Measures were administered over two sessions with order of administration randomised between groups. The majority of the assessments were conducted in a private clinical room in Hobart, Brisbane or Sydney. For eight participants, assessments were conducted in the home environment due to difficulty travelling to the provided clinic rooms. Primary caregivers were not required to be present during the WISC-III assessment or ABLLS observation sessions but were encouraged to stay if the child became anxious in the unfamiliar surroundings. If the child became distressed, the assessment was terminated immediately.

Parents were asked to assist in the completion of the ABLLS assessment by answering questions relating to their child's skill level. This was particularly in the areas of self-help skills such as the Play and Leisure, Social Interaction, Dressing, Eating, Grooming and Toileting subscales. For school-aged children, their classroom teachers were contacted if assistance was required to complete the ABLLS subscales referring to Group Instruction and Classroom Routines. For the remaining 17 subscales, the assessor used a set of standard materials to assess the child directly. One participant had recently been assessed using the WPPSI-III by a registered psychologist with good experience in

test administration, and so for ethical reasons, and because the test could not be validly re-administered within the time window stipulated in the manual, the results from the independent assessment were used instead of re-administering the test.

After the two assessment sessions had been completed, the investigator obtained information pertaining to the diagnosis of each participant, either by gaining consent to speak directly to the diagnostician or to read diagnostic reports. Written consent was obtained as part of the parental consent form and a copy was provided to the diagnosing clinician if necessary. It is important to note that while the principal examiner was blind to the diagnosis of each child prior to assessment, their experience in the area of autism and related disorders, familiarity with the diagnostic criteria and prior knowledge of some of the children in the study may have provided increased awareness of what the child's diagnosis would most likely be.

Results

Data Treatment and Preliminary Analyses

Mean ages were calculated for the Autism group (n = 14, M = 93.93 months, SD = 26.08) and Asperger's Syndrome group (n = 12, M = 121.58 months, SD = 23.49) with the Asperger's Syndrome group being an average of 27.65 months older than the Autism group. However, the highly similar SDs in the two groups indicates a similar distribution of ages within each group.

An independent samples *t*-test was conducted ($t = -2.82$, $p = .009$, 24 *df, Cohen's d=-1.114*) using SPSS version 17 demonstrated that the two groups were significantly different in terms of average age. The Cohen's *d* confirmed a large effect size with a prediction of 58.9% of non-overlap between the two groups. Due to the significant difference in ages between the two groups it was necessary to subsequently correct for age differences in age-sensitive scores in any between-groups analyses.

ABLLS assessments were completed by a trained administrator through observation and obtaining parent feedback for all twenty-six participants (Autism group $n = 14$, Asperger's Syndrome group $n = 12$). However only 23 participants had valid WISC-III data that could be used for comparison. One participant from the Autism group was unable to be assessed using the WISC-III assessment and one participant from each group was assessed using the WPPSI-III, as this was deemed a more appropriate measure for each child. The data for these participants were therefore omitted from the subtest analyses but the two WPPSI results were included in IQ-based analyses.

Raw scores and standard scores were computed according to the relevant Wechsler manual for each participant (Wechsler, 1991 & 2003). Means and standard deviations on the WISC subtests were then calculated for each diagnostic group.

ABLLS protocols were scored for each participant in accordance with instructions from the manual (Partington & Sundberg, 1998), yielding raw scores on each of 25 sub-scales each having different numerical bases. Therefore, in order to explore differentiation of behavioural profiles within each diagnostic group using the ABLLS, scaled scores were

created for the ABLLS subscales so that their mean scores could be validly compared within each diagnostic group, and meaningful indices based on group scores calculated for discriminant analyses. The following formula was used:

$$\frac{\text{(score – mean for the subtest)}}{\text{standard deviation}}$$

For ease of interpretation and to remove negative values, the figure four was added to each score, otherwise expressed in standard deviation terms.

A series of Pearson's correlations was conducted in order to examine the relationship between age in months and raw subtest scores of the WISC-III and the ABLLS. Table 1 shows the correlation coefficients for each subtest for the WISC-III using raw scores for the entire sample, Autism group and Asperger's Syndrome group.

Table 1
Pearson's Correlations Between Age in Months and WISC-III Raw Scores.

	Total Sample		Autism Group		Asperger's Syndrome Group	
Subtest		*P*		*P*		*P*
Information	.60	.002*	.42	.16	.41	.211
Similarities	.66	.000*	.48	.10	.43	.192
Arithmetic	.81	.000*	.85	.00*	.48	.131
Vocabulary	.76	.000*	.70	.01*	.52	.105
Comprehension	.76	.000*	.68	.01*	.60	.053
Digit Span	.78	.000*	.77	.003*	.41	.217
Picture Completion	.83	.000*	.86	.00*	.39	.240
Coding	.80	.000*	.66	.02*	.80	.003*
Picture Arrangement	.76	.000*	.71	.01*	.47	.150
Block Design	.81	.000*	.90	.00*	.54	.089
Object Assembly	.84	.000*	.86	.00*	.62	.043*
Symbol Search	.80	.000*	.73	.01*	.63	.040*
Mazes	.80	.000*	.83	.001*	.45	.161

Note * Denotes significance at .05 level.

Most of the correlations for the whole sample, were positive, strong and significant (.60 to .88), indicating higher scores associated reliably and strongly with greater age. For the Autism group, most correlations between subtest score and age were also positive, strong and significant except for Information and Similarities (.42 and .48 respectively). However, for the Asperger's group, only Coding (.80), Object Assembly (.62) and Symbol Search (.63) maintained the age relationship. All other coefficients are smaller than those for the Autism group and most did not reach significance. Therefore, the Asperger's group did not show as predictable a pattern of increases in cognitive skills associated with increases in chronological age.

A similar pattern emerged when examining the ABLLS subscales. Table 2 displays the correlations between ABLLS subscales raw scores and age in months. For the whole sample there were positive and significant correlations ranging from moderate to strong (.44 to -.79), with the exception of the Grooming Subscale, which has a non-significant and low positive correlation (.38). When the sample is broken into the sub-groups however, different patterns emerge. For the Autism group, correlations of a similar size to those of the whole sample emerge, and most show a positive and significant relationship between age and each ABLLS measure. This indicates that as age increases, so does competence in a large variety of adaptive behaviours. The seven subtests with non-significant correlations are Spontaneous Vocalisations (.46), Syntax and Grammar (.69), Play and Leisure Skills (.52), Group Instruction (.51), Eating (.50), Grooming (.38), Toileting (.41), and Gross Motor (.52).

Table 2
Pearson's Correlation Between Age in Months and ABLLS Raw Scores

Subtest	Total Sample Correlation	*p*	Autism Correlation	*P*	Asperger's Syndrome Correlation	*p*
Cooperation & Reinforcer Effectiveness	.62	.001*	.62	.018*	-.57	.054
Visual Performance	.65	.000*	.66	.011*	.31	.334
Receptive Language	.70	.000*	.76	.002*	-.42	.175
Imitation	.62	.001*	.63	.017*	-.25	.439
Vocal Imitation	.66	.000*	.65	.012*	.17	.608
Requests	.65	.000*	.73	.003*	-.27	.398
Labelling	.71	.000*	.75	.002*	.07	.829
Intraverbals	.73	.000*	.76	.002*	.47	.122
Spontaneous Vocalisations	.53	.005*	.46	.102	.17	.592
Syntax & Grammar	.72	.000*	.69	.0068	.62	.033*
Play & Leisure	.44	.024*	.52	.059	-.40	.196
Social Interaction	.51	.008*	.61	.020*	-.17	.590
Group Instruction	.44	.024*	.51	.062	-.42	.169
Classroom Routines	.47	.015*	.64	.013*	-.60	.040*
Generalised Responding	.64	.000*	.75	.002*	-.23	.477
Reading	.61	.001*	.59	.027*	-.34	.273
Math	.79	.000*	.80	.001*	-.59	.043*
Writing	.68	.000*	.70	.005*	.61	.035*
Spelling	.73	.000*	.72	.003*	.48	.116
Dressing	.65	.000*	.62	.018*	.29	.354
Eating	.48	.014*	.50	.067	-.55	.062
Grooming	.38	.058	.38	.178	-.61	.034
Toileting	.44	.024*	.41	.142	-	-
Gross Motor	.58	.002*	.52	.055	.19	.550
Fine Motor	.65	.000*	.65	.011*	-	-

**Denotes significance*

When the coefficients for the Asperger's Syndrome group are examined, very few of the coefficients are significant and many are not positive. The subtests with significant correlations are Syntax and Grammar (.62), Classroom Routines (-.60), Math (-.59) and Writing (.61). A far more stable and predictable age-related pattern of adaptive skills for the Autism group, but this seems to disintegrate to a large extent for the Asperger's group.

The correlations between age and ABLLS and WISC measures for the whole sample indicate mostly medium to high *r* values. Therefore the age effect in the sample is substantial, and along with significant and large age-difference between the two sample groups, it was important to correct for an age effect in any between-groups analyses involving both ABLLS and WISC measures, particularly in regard to measures for the Autism group.

Between-Groups Analyses

In order to examine the distinctiveness or otherwise of autism and Asperger's Syndrome, between-groups analyses were carried out on the mean WISC –III scores calculated for the groups of children in the present sample who were independently diagnosed as having Asperger's Syndrome and autism (see Table 3).

The mean WISC-III raw and scaled scores for each diagnostic group presented in Table 3 indicate that the Asperger's Syndrome group scored higher on every subtest than did the Autism group. The significance of these differences was tested using a multivariate

Table 3
Mean Raw and Scaled Subtest Scores and Standard Deviations on WISC III for Children Diagnosed with Autism and Asperger's Syndrome

WISC III Subtest	Autism (n = 12)				Asperger's Syndrome (n = 11)			
	Raw Score		Scaled Score		Raw Score		Scaled Score	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Information	5.67	4.36	5.00	2.56	14.00	5.24	9.27	4.56
Similarities	5.25	5.46	5.00	3.86	16.82	5.81	10.91	3.81
Arithmetic	5.83	5.56	3.08	3.00	15.27	4.56	8.55	3.98
Vocabulary	8.33	7.13	3.67	3.03	23.64	7.41	8.09	2.88
Comprehension	3.92	4.76	2.17	2.13	15.82	6.35	7.09	3.15
Digit Span	5.25	4.16	4.50	3.32	10.73	2.57	7.55	2.30
Picture Completion	10.00	9.01	6.17	5.01	18.36	4.01	9.55	3.11
Coding	20.50	17.04	4.50	3.83	40.82	10.39	8.82	2.23
Picture Arrangement	12.08	13.93	6.00	5.10	28.64	7.43	10.09	2.43
Block Design	23.58	21.09	9.08	5.57	36.27	14.43	10.64	3.78
Object Assembly	15.67	12.33	7.50	4.30	26.27	7.58	10.09	2.55
Symbol Search	9.83	8.46	5.08	3.61	15.30	9.92	9.73	3.64
Mazes	10.33	10.76	7.00	6.63	18.91	4.76	10.55	3.64

analysis of variance (MANOVA) using the scaled scores of the WISC-III as dependent variables, and with diagnostic group (Autism/Asperger's Syndrome) as the independent variable. The scaled scores of the WISC are age-corrected scores, thus ensuring valid comparisons between the Asperger's Syndrome and Autism groups, which were significantly different in age (see *Preliminary Analyses* above). An alpha level of .05 was adopted for all analyses.

Using the Wilks Lambda criteria, the between-groups multivariate test of difference was statistically significant, $F(13,9) = 9.49$, $p=.001$. In terms of specific WISC subtests, scaled scores demonstrated significant differences between the groups in a majority of subtest means, with the exception of Block Design, Object Assembly, Picture Completion and Mazes, all of which are non-verbal (Performance) subtests. Significant differences were found between diagnostic groups for all the Verbal subtests of the WISC-III: Information, $F(1,21) = 7.85$, $p=.01$, $d=1.15$; Similarities $F(1,21) = 13.62$, $p=.001$, $d=1.54$; Arithmetic, $F(1,21) = 13.96$, $p=.001$, $d=1.55$; Vocabulary, $F(1,21) = 12.85$, $p=.002$, $d=.11$; Comprehension, $F(1,21) = 19.67$, $p<.01$, $d=1.83$; and Digit Span, $F(1,21) = 6.43$, $p=.02$, $d=1.07$. Significant between-groups differences were found for three out of the seven Performance subtests (42.86%): Coding, $F(1,21) = 10.67$, $p=.004$, $d=1.38$; Picture Assembly, $F(1,21) = 5.85$, $p=.03$, $d=1.02$; and Symbol Search, $F(1,21) = 9.45$, $p=.01$, $d=1.28$.

From Table 4 it is apparent that the Asperger's Syndrome group means exceed those of the Autism group in three IQ measures. A multivariate test of differences between groups using the Wilks Lambda criteria was used and was found to be statistically

significant, $F(3,22) = 173.37$, $p<.01$. The Asperger's Syndrome group demonstrated significantly higher scores for Verbal IQ, $F(1) = 17.58$, $p<.01$, $d=1.66$, Performance IQ, $F(1) = 5.76$, $p=.02$, $d=.98$ and Full Scale IQ, $F(1) = 12.74$, $p<.01$ $d=1.43$. In all cases, there were large magnitude differences in IQ between the two groups.

Table 4 shows the means and standard deviations for IQs in both groups.

Table 4
Mean and Standard Deviations for WISC-III Scores on Verbal IQ, Performance IQ and Full Scale IQ for Children Diagnosed with Autism and Asperger's Syndrome.

	Autism (n=13)		Asperger's Syndrome (n=12)	
	Mean	*SD*	Mean	*SD*
Verbal IQ	61.86	20.58	93.42	17.28
Performance IQ	77.07	30.68	99.33	10.03
Full Scale IQ	67.29	24.17	95.75	14.35

The standard deviation for IQ values in the WISC-III for the general population is 15 (Wechsler, 1991). The Autism group demonstrated greater variability in PIQ (*SD* = 30.68) than VIQ (*SD* = 20.58). Both these figures are much higher than the standard deviation for the general population (see WISC-III manual, Wechsler, 1991). The Asperger's Syndrome group displayed standard deviations much closer to those of the general population; PIQ in fact showing a lower standard deviation than that of the general population (*SD* =10.03). It is possible that small sample numbers might have exaggerated the variability in the scores. However, on examination of scatterplots for both samples with age, no outliers were found in the data that may have created larger than usual standard deviations.

In order to test hypotheses related to the question of distinctiveness of autism and Asperger's Syndrome, a similar analysis was carried out using ABLLS data. The mean ABLLS raw and standard scores for each group are presented in Table 5. As with the WISC-based analysis the Asperger's Syndrome group scored higher on every subscale when compared to the Autism group. The Asperger's Syndrome group also demonstrates consistently smaller standard deviations.

Nonetheless, the standardised scores created for the ABLLS subscales do not account for age differences in the same way the subtest scores of the WISC-III do. In order to control for the age difference between the two groups and to validly measure the difference in subscale scores between the two groups, it was necessary to carry out a Multiple Analysis of Covariance (MANCOVA) using age in months of the individuals as a covariate. When using raw scores in the analysis, the MANCOVA demonstrated a significant overall effect: Pillai's Trace 1.00, $F(1,23) = 953.87$, $p = .03$ indicating that the between-groups effect is significant for the subscales of the ABLLS, with the variability due to age differences in the groups taken into consideration.

When comparing differences in individual subscale scores between groups, all ABLLS subscales except Toileting, $F(2,25) = 3.358$, $p = .05$, show that Asperger's Syndrome group scored significantly higher than the Autism group. Table 6 presents the F and p values for all subscales from the ABLLS.

Table 5

Mean Raw and Scaled Subtest Scores and Standard Deviations on the ABLLS for children diagnosed with Autism and Asperger's Syndrome

ABLLS Subscale	Autism (n = 14)				Asperger's Syndrome (n = 12)			
	Raw Score		Scaled Score		Raw Score		Scaled Score	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Cooperation & Reinforcer Effectiveness	25.93	3.39	3.42	1.06	29.92	0.29	4.68	0.09
Visual Performance	58.57	16.64	3.47	1.12	75.75	0.45	4.62	0.30
Receptive Language	124.36	29.51	3.41	1.05	160.33	1.92	4.69	0.07
Imitation	36.00	9.95	3.48	1.14	45.83	0.39	4.61	0.04
Vocal Imitation	27.50	5.93	3.43	1.06	34.42	1.08	4.67	0.19
Requests	40.57	15.42	3.40	1.00	60.67	4.76	4.70	0.31
Labelling	80.14	39.32	3.35	0.97	137.25	3.93	4.76	0.10
Intraverbals	62.29	52.37	3.30	0.86	154.83	9.08	4.82	0.15
Spontaneous Vocalisations	23.21	5.91	3.53	1.12	28.58	2.35	4.55	0.44
Syntax & Grammar	16.43	13.21	3.31	0.89	38.58	3.03	4.80	0.20
Play & Leisure	21.93	9.68	3.52	1.06	31.42	5.18	4.56	0.57
Social Interaction	27.93	13.66	3.50	0.95	43.42	10.34	4.58	0.72
Group Instruction	18.64	11.98	3.45	0.95	33.83	7.69	4.65	0.61
Classroom Routines	12.50	7.29	3.47	0.99	21.00	4.24	4.62	0.58
Generalised Responding	7.93	3.00	3.45	1.03	11.42	1.24	4.64	0.43
Reading	25.57	20.53	3.45	1.10	47.75	0.45	4.64	0.02
Math	31.00	23.34	3.40	0.96	62.92	10.34	4.71	0.42
Writing	19.43	12.41	3.48	1.13	31.83	0.58	4.61	0.05
Spelling	5.86	5.91	3.34	0.91	15.25	1.87	4.78	0.29
Dressing	19.07	8.64	3.38	1.00	30.75	0.87	4.73	0.10
Eating	14.64	3.84	3.45	1.04	19.08	1.44	4.65	0.39
Grooming	8.36	4.52	3.47	1.05	13.25	2.01	4.61	0.47
Toileting	16.86	5.52	3.66	1.29	20.00	0.00	4.39	0.00
Gross Motor	23.50	3.55	3.49	1.11	27.08	1.00	4.60	0.31
Fine Motor	21.50	5.49	3.42	1.06	28.00	0.00	4.68	0.00

Within-Groups Analyses

In order to further explore hypotheses related to the question of the distinctiveness of autism and Asperger's Syndrome, a number of within-groups analyses were carried out using both WISC-III and ABLLS data. From Table 3 the highest average scaled scores for the WISC-III for the Autism group were Block Design, Object Assembly and Mazes. Comprehension, Arithmetic and Vocabulary comprised the three lowest scaled score means for the Autism Group. When examining means for the WISC-III scaled scores for the Asperger's Syndrome Group, Similarities, Block Design and Mazes were the three highest scoring subtests. Comprehension, Digit Span and Vocabulary showed the three lowest mean scaled subtest scores. In order to determine whether the cognitive profiles of participants within the Asperger's Syndrome and the Autism groups were on average, significantly differentiated, repeated measures ANOVAs were conducted in order to determine significant differences between the WISC-III subtest scaled scores within each diagnostic group.

The repeated measures ANOVA for the Autism group was significant, $F(12,132) = 4.88$, $p<.01$. Only two pairs of subtests however revealed significant differences: the Information subtest mean was significantly higher than the Comprehension subtest mean ($p=.02$); and the mean score for Block Design was significantly higher than the Arithmetic mean ($p=.04$). No other of the possible contrasts between subtests showed significant differences in their standard scores (see Table 3 for means and standard deviations).

Table 6
F and p Values Achieved for Between-groups Analyses Using ABLLS Raw Scores with Age Correction

Subtest	*F* Value	*p*
Cooperation & Reinforcer Effectiveness	12.73	<.001
Visual Performance	12.25	<.001
Receptive Language	17.98	<.001
Imitation	10.57	.001
Vocal Imitation	14.23	<.001
Requests	15.69	<.001
Labelling	23.90	<.001
Intraverbals	35.85	<.001
Spontaneous Vocalisations	6.60	.005
Syntax & Grammar	30.86	<.001
Play & Leisure	5.43	.012
Social Interaction	6.86	.005
Group Instruction	7.59	.003
Classroom Routines	7.28	.004
Generalised Responding	12.43	<.001
Reading	12.25	<.001
Math	30.68	<.001
Writing	13.48	<.001
Spelling	28.88	<.001
Dressing	17.38	<.001
Eating	8.07	.002
Grooming	6.02	.008
Toileting	3.36	.053
Gross Motor	9.11	.001
Fine Motor	14.62	<.001

A similar repeated measures ANOVA examining the mean profile of the Asperger's Syndrome group was significant, $F(12,120) = 2.53$, $p=.01$, but the only significant difference in mean scaled scores for this group was between the Similarities subtest and the Comprehension subtest ($p=.02$), with the mean score for Similarities significantly

higher than that of Comprehension (see Table 3 for means and standard deviations). No other possible contrasts showed any significant differences.

When examining within-group differences between global intelligence measures (see Table 4), the Autism group's mean VIQ score of 61.86 contrasts markedly with a mean PIQ score of 77.07 creating a difference of 15.21. According to the WISC-III Manual (Wechsler, 1991), a difference of 11.3 is statistically significant for all ages, meaning that the VIQ scale is significantly lower than PIQ for the Autism group. The difference between the two global measures for the Asperger's Syndrome group is not as pronounced with only a 5.91-point difference. While the VIQ scale is lower than PIQ, this difference is not statistically significant.

From Table 5, the highest average scaled scores for the ABLLS for the Autism group were Toileting, Spontaneous Vocalisations and Play with Intraverbals, Syntax and Grammar and Spelling being the lowest subtest scores. The opposite was true of the Asperger's Syndrome group with the highest subtests being Intraverbals, Syntax and Grammar and Spelling and the lowest being Toileting, Play and Spontaneous Vocalisations.

However, in order to determine whether the cognitive profiles of participants *within* the Asperger's Syndrome and the Autism groups were on average, reliably differentiated, repeated measures ANOVAs were conducted in order to determine significant differences between the ABLLS subscale standard scores within each diagnostic group.

For the Autism group (n=14), tests of within-subjects effects with correction for repeated measures were non-significant, Huyun-Feldt: F (17.48, 227.19)= 0.23, p=1.00. Multivariate tests were also non-significant for the ABLLS (Pillai's Trace= .95, F(1,13)= 1.54, p=.57), as was the case for tests of within-subjects contrasts (F=.09, p=.77, 1 *df*). Consequently, none of the Bonferroni-corrected contrasts showed any significance with p >.05 in all cases.

Tests of within-subjects effects with correction for repeated measures were also non-significant for the Asperger's Syndrome Group (n=12), Huyun-Feldt: F(6.46, 71.09)=.95, p=.47. Likewise, multivariate tests for the ABLLS effect were non-significant (Pillai's Trace=1.00, F(1,11)=44.17, p=.12), as was the case for tests of within-subjects contrasts, F=2.58, p=.14, 1*df*.

In order to further test the model of discontinuity between the Asperger's Syndrome and autism, whereby the cognitive profiles of the two diagnostic groups would be distinctive in terms of expected patterns of strengths and weaknesses, several related-samples t tests were carried out to determine the significance or otherwise of hypothesised differences between the mean scaled scores on specified subtests of WISC-III and the mean of an aggregate of scaled scores on the subtests. Because of the large differences found between the VIQ and PIQ of the Autism group in the present sample, it was considered more appropriate to compare single subtest means with an aggregate of like subtests. Therefore a Verbal subtest was compared with an aggregate, consisting of the grand mean of all the Verbal subtest scores, and likewise for Performance subtests. Comparing single subtest means with an aggregate of all subtest means could have

inflated differentials between single Verbal subtests with a total including Performance subtests, since Verbal subtests were generally depressed in comparison with Performance subtests.

In order to exhaustively test the hypothesis, the expected differences were tested in the group in which they were supposed to be manifest (ie, the target group). As well, a similar analysis was carried out for the group to which the specific hypothesis was not applicable (ie, the non-target group). For example, if it was expected that the Autism group would exhibit a significantly elevated Block Design score compared with the aggregate of all Performance subtests, this contention was also tested in regard to the Asperger's Syndrome group as well. An adequate test of the hypothesis for distinctiveness would need to demonstrate not only that the hypothesised difference was in the expected direction, was significant, and was of a clinically notable size in the target group, but that it was not found to an equal extent in the non-target group. Thus findings supportive of a *discontinuity* stance consisted of significant and moderate-to-large effects in the direction predicted for the target group which were matched in the non-target group with either non-significant small effects, or significant effects in the opposite direction to those predicted for the target group. On the other hand, non-significant and small effects in the target group matched with similar non-significant effects in the non-target group would discount the discontinuity stance and instead suggest *continuity* between groups; as would significant and moderate-to-large effects in the predicted direction for the target group similarly matched in the non-target group. As well, significant and moderate-to-large effects in the *opposite* direction to that predicted for the target group, matched in the non-target group, would signal a continuity stance

rather than a discontinuity stance. Finally, non-significant and small effects for the target group, matched with significant medium-to-large effects in the non-target group, in the direction predicted for the target group would also discount a discontinuity stance. Table 7 outlines the findings testing discontinuity hypotheses for the Autism group.

Table 7

Of the four sets of results, the Block Design results and the Comprehension results are supportive of a discontinuity stance. Block Design is significantly higher than the total mean of all Performance subtests and the corresponding contrast in the Asperger's Syndrome group is non-significant. Cohen's *d* statistic indicates the difference between Block Design and the total mean of all Performance subtests to be of moderate size. The Comprehension score for the Autism group is significantly lower than the Verbal Subtest Aggregate score as predicted, and the difference is of large magnitude.

However, the reverse is the case for the Asperger's Syndrome group, and significantly so with an equally strong effect size giving support to discontinuity between groups. The Object Assembly results show non-significant differences for both the Autism and Asperger's Syndrome groups, results that are also seen for Vocabulary. Both sets of results are supportive of continuity between groups rather than discontinuity.

A similar analysis was conducted in order to test the discontinuity hypotheses specific to the Asperger's Syndrome group. Table 8 presents the findings. None of the hypotheses specific to distinctive cognitive patterns expected in Asperger's Syndrome were upheld,

Table 7

Discontinuity Hypotheses Specific to Autism Group and Results of Related-samples t Tests and Cohen's d Statistics Comparing WISC-III Subtest Mean Scores within Autism and Asperger's Syndrome Groups

Hypothesis	Target Group for Hypothesis: Autism (n = 12)								Non-target Group for Hypothesis: Asperger's Syndrome (n = 11)							
	d	M1	SD1	M2	SD2	*t*	*p*	*df*	*d*	M1	SD1	M2	SD2	*t*	*p*	*df*
BD > PSA	.61	9.77	4.66	7.20	3.70	4.78	.001*	12	.48	10.58	3.61	9.22	1.81	1.51	.150	11
OA > PSA	.26	8.15	3.65	7.20	3.70	1.66	.120	12	.08	10.09	2.55	9.92	1.88	0.20	.848	10
C < VSA	-.90	2.54	2.07	4.33	1.91	-3.72	.003*	12	.92	7.09	3.15	4.33	2.84	-4.22	.002*	10
V < VSA	-.14	4.00	2.71	4.33	1.91	-0.60	.560	11	-.18	8.00	2.76	8.49	2.72	-1.01	.340	11

Note: BD = Block Design, OA = Object Assembly, C = Comprehension, V = Vocabulary, PSA = Performance Subtest Aggregate (grand mean of all Performance subtest scores), VSA = Verbal Subtest Aggregate (grand mean of all Verbal subtest scores), *M1* = Mean score of single subtest, *M2* = Mean score of subtest aggregate, *SD1* = standard deviation score of single subtest, *SD2* = standard deviation of subtest aggregate. All means are expressed in scaled scores for WISC-III subtests.

Table 8

Discontinuity Hypotheses Specific to Asperger's Syndrome Group and Results of Related-samples t Tests and Cohen's d Statistics Comparing WISC-III Subtest Mean Scores within Asperger's Syndrome and Autism Groups

Hypothesis	Target Group for Hypothesis: Asperger's Syndrome (n = 11)								Non-target Group for Hypothesis: Autism (n = 12)							
	d	M1	SD1	M2	SD2	*t*	*p*	*df*	*d*	M1	SD1	M2	SD2	*t*	*p*	*df*
IN > VSA	.19	9.17	4.37	8.49	2.72	.834	.42	11	.55	5.38	1.94	4.33	1.91	2.72	.02*	12
V > VSA	-.18	8.00	2.76	8.49	2.72	-1.01	.34	11	-.14	4.00	2.71	4.33	1.91	-0.60	.56	11
OA < VSA	.08	10.09	2.55	9.92	1.88	.197	.85	10	.26	8.15	3.65	7.20	3.70	1.66	.12	12
CD < PSA	-.52	8.83	2.13	9.85	1.81	-2.30	.04*	11	-.64	4.92	3.43	7.20	3.70	-2.20	.05*	12
DS < VSA	-.40	7.55	2.30	8.58	2.84	-1.43	.18	10	.31	5.08	3.06	4.29	1.99	1.34	.21	11

Note: IN = Information, V = Vocabulary, OA = Object Assembly, CD = Coding, DS = Digit Span, VSA = Verbal Subtest Aggregate (grand mean of all Verbal subtest scores), PSA = Performance Subtest Aggregate (grand mean of all Performance subtest scores), *M1* = Mean score of single subtest, *M2* = Mean score of subtest aggregate, *SD1* = standard deviation score of single subtest, *SD2* = standard deviation of subtest aggregate. All means are expressed in scaled scores for WISC-III subtests.

and instead showed patterns of results supportive of the continuity stance. Coding compared to the Performance Aggregate Score was significantly lower as predicted for the Asperger's Syndrome group, but it was also significantly lower for the Autism group, demonstrating similar profiles on this measure. No other discontinuity hypotheses were upheld for the Asperger's Syndrome group. It is interesting to note that while the Information subtest was not significantly higher than the aggregate score for the Verbal subtests for the Asperger's Syndrome group, it was significantly higher for the Autism group suggesting continuity.

The same method of analysis was conducted in order to test the model of discontinuity using ABLLS subscales. Several related-samples *t* tests were carried out to determine the significance or otherwise of hypothesised differences between the mean scaled scores on specified subscales of the ABLLS and the mean of an aggregate of scaled scores on the subscales. Table 9 presents the target findings for the Autism group.

No hypothesised differences were found to be significant for the Autism group however both the Labelling and Intraverbal subscales were found to be significantly differentiated from the ABLLS aggregate for the Asperger's Syndrome group suggesting discontinuity. Visual Perception showed similar non-significant trends in both groups supporting continuity.

Table 9

Discontinuity Hypotheses Specific to Autism Group and Results of Related-samples t Tests and Cohen's d Statistics Comparing ABLLS Subscale Mean Scores within Autism and Asperger's Syndrome Groups

Hypothesis	Target Group for Hypothesis: Autism (n = 12)								Non-target Group for Hypothesis: Asperger's Syndrome (n = 11)							
	d	M1	SD1	M2	SD2	*t*	*p*	*df*	*d*	M1	SD1	M2	SD2	*t*	*p*	*df*
VP > TTL	.03	3.47	1.12	3.44	.86	.12	.91	13	-.32	4.62	.03	4.65	.13	-.75	.47	11
L < TTL	-.10	3.35	.97	3.44	.86	-1.19	.25	13	.95	4.76	.10	4.65	.13	5.41	<.001*	11
IV < TTL	-.16	3.30	.86	3.44	.86	-1.62	.13	13	1.21	4.82	.15	4.65	.13	4.19	.002*	11
PL < TTL	.08	3.52	1.06	3.44	.86	.49	.63	13	-.22	4.56	.57	4.65	.13	-.68	.513	11

Note: VP = Visual Performance, L = Labelling, IV = Intraverbals, PL = Play and Leisure Skills, TTL = ABLLS Subscale Aggregate (grand mean of all ABLLS subscale scores), *M1* = Mean score of single subtest, *M2* = Mean score of subscale aggregate, *SD1* = standard deviation score of single subtest, *SD2* = standard deviation of subscale aggregate. All means are expressed in scaled scores for ABLLS Subscales.

For the Asperger's Syndrome group hypotheses, only one of the expected differences was confirmed as significant, the Intraverbals subscale, and in the expected direction. The Autism group shows a non-significant difference for this contrast, confirming the Asperger's Syndrome finding as a distinctive one. All the remaining hypothesised differences were non-significant, findings which were mirrored in the Autism group. Table 10 presents the findings for the Asperger's Syndrome group. Thus, for both groups, only one of the seven discontinuity-related hypotheses was confirmed, with the results largely supportive of the continuity stance.

Discriminant Function Analyses

In order to address the aims concerning the objective measures that might best discriminate children exhibiting Asperger's Syndrome and autistic symptomatology, and the concurrent validity of these measures; separate Fisher's linear discriminant function analyses were carried out using WISC-III and ABLLS data.

WISC-based Discriminant Function Analysis

Standard scores on the WISC-III VIQ, PIQ and FSIQ measures were used in a Fisher discriminant function analysis to determine group membership of cases based on a two-group theoretical model (Autism vs Asperger's Syndrome). A total of 25 cases from the sample were initially included in this analysis; but one case did not complete tests of cognitive function and did not yield results for VIQ, PIQ and FSIQ. These three measures could be legitimately used in the analysis as they were age-corrected indices and controlled for age differences between the two groups. All three IQ measures

Table 10

Discontinuity Hypotheses Specific to Asperger's Syndrome Group and Results of Related-samples t Tests and Cohen's d Statistics Comparing ABLLS Subscale Mean Scores within Asperger's Syndrome and Autism Groups

Hypothesis	Target Group for Hypothesis: Asperger's Syndrome (n = 12)								Non-target Group for Hypothesis: Autism (n = 14)							
	d	M1	SD1	M2	SD2	*t*	*p*	*df*	*d*	M1	SD1	M2	SD2	*t*	*p*	*df*
IV > TTL	1.21	4.82	.15	4.65	.13	4.19	.002*	11	-.16	3.30	.86	3.44	.86	-1.62	.13	13
SI > TTL	-.14	4.58	.72	4.65	.13	-.39	.70	11	.07	3.50	.95	3.44	.86	.47	.66	13
GM< TTL	-.21	4.60	.31	4.65	.13	-.48	.64	11	.05	3.49	1.11	3.44	.86	.22	.83	13
FM < TTL	.33	4.68	.00	4.65	.13	.67	.52	11	-.02	3.42	1.06	3.44	.86	-.10	.92	13

Note: IV = Intraverbals, SI = Social Interaction, GM = Gross Motor, FM = Fine Motor, TTL = ABLLS Subscale Aggregate (grand mean of all ABLLS subscale scores), *M1* = Mean score of single subtest, *M2* = Mean score of subscale aggregate, *SD1* = standard deviation score of single subtest, *SD2* = standard deviation of subscale aggregate. All means are expressed in scaled scores for ABLLS Subscales.

reached the tolerances needed to enter the analysis, and thus were successful in reliably discriminating cases between the two groups.

The canonical correlation analysis using all three IQ measures yielded a canonical correlation coefficient of .70 with an Eigenvalue of 0.98. This function, based on IQ is highly significant (Wilk's Lambda =.51, Chi Square = 14.64; 3 *df*, p =.002). Therefore, the WISC IQ data in combination discriminated cases into two distinctive groups very reliably.

When examining correlation coefficients, VIQ was the superior discriminator with a coefficient of .99, followed by FSIQ with a correlation of .83. PIQ was the least efficient discriminator with a modest coefficient of .50. However, the p values from the casewise statistics indicate that only a minority of cases in the sample were reliably classified into one group or another by the present two-group function with seven cases showing p values of <.05 for their respective grouping. Thus using all three WISC IQ measures and a two-group function, only reliably discriminates 28% of the present sample at the designated .05 probability level. Discriminant scores were derived from the squared Mahalanobis distances from the two group centroids, and appear in Table 11 below, along with group classification according to the two-group function, based on the discriminant scores for each case.

When comparing classifications made by diagnosticians, whether the child was diagnosed and classified as either belonging to the Autism group or the Asperger's group, with the statistically generated classification based on WISC IQ measures, the

Table 11
Discriminant Scores and Group Allocation for Dichotomous Group Classification of 25 Children Based on WISC-III Subtest Scores and Diagnosticians' Clinical Judgment.

Case Number	Discriminant Score	Predicted Group Allocation According to Function	Group Allocation by Diagnostician*	*p* Level**
1	.39	2	1	.340
2	-1.85	1	1	.027
3	-1.22	1	1	.084
4	-1.24	1	1	.082
5	-1.03	1	1	.117
6	-.73	1	1	.189
7	-1.01	1	1	.120
8	-1.99	1	1	.021
9	.32	2	1	.368
10	-.25	1	1	.367
11	-1.24	1	1	.082
12	-.48	1	1	.274
13	-1.52	1	1	.050
14	.36	2	2	.351
15	.70	2	2	.222
16	.10	2	2	.468
17	1.99	2	2	.024
18	2.62	2	2	.007
19	.79	2	2	.195
20	2.07	2	2	.021
21	-1.71	1	2	.035
22	-.04	1	2	.464
23	2.28	2	2	.014
24	1.37	2	2	.075
25	1.31	2	2	.082

Note:* 1 =Autism; 2 =Asperger's Syndrome; ** Posterior probability levels derived from Mahalanobis distances from the relevant group centroid.

present results show an 84% overlap in the two classifications. Most of the children in the sample that the function classified as Group 1, the diagnostician placed in Group 1 (Autism); and the majority of the children that the function classified as Group 2, the

diagnostician placed in Group 2 (Asperger's Syndrome). The Kappa Statistic shows a value of .68 ($p < .001$), indicating highly significant level of agreement based on 25 cases and correcting for chance agreement. Two cases from each of the diagnostician-classified groups were misclassified.

For Cases # 1 and #9, the diagnostician placed each child in Group 1 (Autism) but the function marginally placed them in Group 2 (corresponding to Asperger's Syndrome) and Case #22 was placed in Group 2 by the diagnostician (Asperger's Syndrome) but the function marginally placed the child in Group 1 (Autism). The discriminant scores for all three cases were very low: .39 for Case #1, .32 for Case #9 and -.04 for Case #22, and their p values for each grouping did not reach the .05 significance level. Therefore these cases are fairly equidistant from each group centroid and were not reliably placed by the function into either group, but were marginally placed by the function into Group 2 or Group 1 in Case #22. The fourth misclassified case, Case #21 has a much higher discriminant score of -1.71 ($p = -.04$), and was more reliably placed by the function than the other three cases, and reaches significance at the accepted $p < .05$ level.

Discriminant Function Analysis using Aggregate Scores from ABLLS

In order to reduce the number of variables used in the analysis, subscales from the ABLLS were used to create overall means for five separate sub-groupings; Language, Social Behaviour, Academic, Self-Care and Motor Skills. The Language grouping contained the Receptive Language, Vocal Imitation, Requests, Labelling, Intraverbals and Spontaneous Vocalisations subscales. Social Behaviour included the Play and Leisure Skills, Social Interactions, Group Instruction and Classroom Routines subscales.

The Academic subgroup included Reading, Math, Writing and Spelling subscales. Self-Care contained Dressing, Eating, Grooming and Toileting subscales where the Motor Skills Grouping included the Fine and Gross Motor subscales. Cohen recommends 1 variable for every 10 subjects however the current study included 5 measures for 26 cases, therefore the resultant analysis may be somewhat unstable.

A Fisher discriminant function analysis was carried out using the five ABLLS sub-groups in order to determine group membership of cases based on a two-group theoretical model (Autism *vs* Asperger's Syndrome). These measures were not age-corrected and therefore do not in themselves control for the age differences observed between the Asperger's Syndrome and Autism sub-groupings in the present sample. Age in months however was included in the analysis as a co-variable, and the resulting discriminant statistics including casewise statistics reflect the effect of age differences between the two groups, as well as the variables of interest ie, the ABLLS indices as discriminators. All ABLLS indices as well as the age variable reached the tolerances needed to enter the analysis, producing reliable discriminations.

The analysis yielded an Eigenvalue of .998 and a canonical correlation of .71. The ABLLS indices accounted for slightly more of the discriminatory variance than did the WISC IQ measures (WISC Eigenvalue 0.88), and yielded a slightly higher canonical correlation coefficient (ABLLS = .71; WISC = .69). When the function based on ABLLS data demonstrated significance (Wilk's Lambda =.50, Chi Square = 14.54; 6 *df*, p =.02). Like the WISC IQ data used for discriminating cases into two distinctive groups, the ABLLS indices with age differences accounted for, also reach the .05 significance level. Looking at the comparative significance of the function for WISC and

ABLLS, WISC (p =.003) appears superior to the ABLLS data in terms of its reliability, but both are highly reliable discriminators.

The ABLLS beta values all indicate strong correlations (.76 to .96) – in comparison age is a very modest discriminator (.58). The WISC discriminant analysis shows a similar result for VIQ (.91) compared to the strongest ABLLS discriminators (Language .96 and Academic .93), and it is interesting that the more "cognitive" ABLLS subtests in combination discriminate as well or better than the WISC Verbal subtests, which are more academically related than the Performance subtests, which are supposed to be more a test of fluid intelligence. FSIQ at .78 discriminates about as well as the non-academic social-behavioural markers from the ABLLS. However, interestingly PIQ at .52 is a less efficient discriminator of the two groups than any of the ABLLS indices, and is operating at about the same level as the rather psychologically meaningless and arbitrary variable *age in months*, in sorting the participants into theoretical groupings.

The p values from the casewise statistics indicate that only a minority (19.23%) of cases (#1, #2, #8, #13 and #26) are reliably classified into one group or another by the present two-group function. The ABLLS classification data are very similar to the WISC-based analysis in terms of the proportion of cases that are reliably classified. The same number of cases (and percentage proportionally) were reliably classified by the two-group function when it was based on WISC IQ data. On this basis it appears that the ABLLS data are similar to WISC data in their ability to classify children with Asperger's/Autism

symptomatology into two distinctive groups, and both types of measures are only modestly successful in classifying specific cases into the two theoretical groupings. Discriminant scores were derived from the squared Mahalanobis distances from the two group centroids, and appear in Table 12 below, along with group classification according to the two-group function, based on the discriminant scores for each case.

The present results show an 85.36% overlap in the two classifications – four cases (14.64%) were misclassified. All these cases were classified by the diagnostician as autistic but the function placed them in the Asperger's Syndrome group. Tests of significance (Chi-square = 13.30 $p < .001$) and Kappa statistic show a value of .70 $p < .001$, indicating strong and reliable agreement based on 26 cases. However, it could be concluded that using the ABLLS (behavioural ratings) as the foundation for a function-based analysis, produces similar concordance with clinically-based classification is achieved, as is achieved using scores on a cognitive test.

Table 12
Discriminant Scores and Group Allocation for Dichotomous Group Classification of 26 Children Based on ABLLS grouped Subscale Scores and Diagnosticians' Clinical Judgment.

Case Number	Discriminant Score	Predicted Group Allocation According to Function	Group Allocation by Diagnostician*	*p* Level**
1	-2.18	1	1	.013
2	-1.97	1	1	.019
3	-.65	1	1	.200
4	-.20	1	1	.372
5	-.91	1	1	.132
6	.11	2	1	.483
7	1.09	2	1	.124
8	-1.60	1	1	.038
9	.94	2	1	.160
10	1.00	2	1	.144
11	-1.15	1	1	.086
12	-1.33	1	1	.063
13	-2.34	1	1	.010
14	1.13	2	2	.116
15	1.11	2	2	.121
16	.72	2	2	.224
17	1.06	2	2	.130
18	.96	2	2	.154
19	.97	2	2	.150
20	1.21	2	2	.101
21	.88	2	2	.174
22	1.08	2	2	.127
23	1.31	2	2	.085
24	1.21	2	2	.101
25	.82	2	2	.194
26	-3.26	2	1	.002

Note:* 1 =Autism; 2 =Asperger's Syndrome; ** Posterior probability levels derived from Mahalanobis distances from the relevant group centroid.

Discussion

From the time the term Asperger's Syndrome was introduced to the Western world, debate has ensued as to whether it is a distinct disorder in its own right or whether it forms part of a continuum with autism sharing similar profiles and behavioural characteristics. The principal aim of the present study was to investigate autism and Asperger's Syndrome and determine if in fact the two disorders are distinctive, qualitatively different syndromes or alternately, similar syndromes on the same continuum, distinguished only in terms of severity.

Two models were tested using a set of hypotheses constructed in order to best describe the presentation of either a continuity or a discontinuity stance. If the model of discontinuity was supported, differing profiles should be apparent between groups with contrasting peaks and troughs when comparing cognitive and behavioural measures. In order to support a model of continuity, cognitive and behavioural profiles would be similar when comparing the two groups with closely related peaks and troughs when comparing skill level. In other words, both the Autism group and Asperger's Syndrome group would demonstrate similar strengths and weaknesses across the various subtests from the assessment measures.

In order to confirm a model of discontinuity, it was hypothesised that the two groups would present with different cognitive and behavioural profiles, the Autism group would achieve relatively higher scores on performance subtests such as Block Design and Object Assembly which rely on visual-spatial skills and motor abilities whereas relatively lower scores would be seen in verbal subtests. On the other hand, the

Asperger's Syndrome group would demonstrate superior scores in verbal subtests, with a higher VIQ compared to PIQ, and would present with relatively low scores in subtests involving motor skills.

When comparing WISC-III subtests, the Autism and Asperger's Syndrome groups demonstrated similar profiles. Using scaled scores, both groups had Block Design and Mazes in their top three subtests and both had Comprehension and Vocabulary in their lowest three scoring subtests. Moreover, the profiles of both groups were statistically undifferentiated. Only two pairs of subtests that showed significant differences for the Autism group and one pair in the case of the Asperger's Syndrome group. This signals that the average subtest profiles of the two groups were both relatively "flat" with very few if any notable peaks and troughs. It was interesting to note that when comparing the results for the Autism group with those for the Asperger's Syndrome group, the Block Design subtest was not statistically different as found in past studies (DeMyer et al., 1972; Lincoln et al., 1988; Ehlers et al., 1997; Manjiviona & Prior, 1999 & Ghaziuddin & Mountain-Kimchi, 2004).

When the ABLLS profiles of the two groups were examined, it was apparent the Autism group demonstrated highest scores in Toileting, Spontaneous Vocalisations and Play and Leisure Skills with Intraverbals, Syntax and Grammar and Spelling being the lowest subscale scores. The opposite was true of the Asperger's Syndrome group with the highest average subscale scores being in Intraverbals, Syntax and Grammar and Spelling and the lowest being Toileting, Play and Leisure Skills and Spontaneous Vocalisations. Nonetheless, these differences were not significant when subjected to within-groups

statistical analyses. Thus neither the Autism group nor the Asperger's Syndrome group demonstrated significant profile differentiation.

Both groups had higher mean PIQ scores when compared with VIQ scores although the difference was only significant for the Autism group. Significantly higher PIQ scores in individuals with autism were also found by Koyama et al. (2007), Klin et al. (1995) and Ozonoff et al. (1991). There were large standard deviations in all three global intelligence measures for the Autism group. In particular, the PIQ score showed standard deviations more than twice the size of standard deviations used in the WISC-III manual demonstrating a large variation in skill level within the group.

The discontinuity stance was further tested by a series of group-specific hypotheses, which predicted strengths and weaknesses in WISC and ABLLS profiles that were peculiar to each group, and which were linked to the diagnostic criteria for autism and Asperger's Syndrome. These differences were tested within groups against relevant aggregates of WISC_III subtests and ABLLS subscales. It was predicted that the Autism group would demonstrate relative strengths in the Object Assembly and Block Design subtests and relative weaknesses in the Comprehension and Vocabulary Subtests; whereas the Asperger's Syndrome group would show relative strengths in Information and Vocabulary with relative weaknesses in Digit Span, Object Assembly and Coding. However, only two out of a total of nine sets of WISC results were supportive of the discontinuity stance, and these were for hypotheses specific to the cognitive patterns expected of Autism.

For the ABLLS subscales, it was predicted that in line with a discontinuity stance the Autism group would demonstrate relative strengths in Visual Performance and relative weaknesses in the verbal subscales of Labelling and Intraverbals. However, none of these hypotheses were upheld. For the Asperger's Syndrome it was predicted that this group would show relative strengths in Labelling and Intraverbals, and relative weaknesses in Gross and Fine Motor Skills and in Social Interaction. In these analyses, only two of the discontinuity hypotheses were upheld. While no studies have been published using the ABLLS protocol to compare profiles of Asperger's Syndrome and autism, and there is limited research comparing the functioning levels of the two groups in terms of daily living skills, similar behavioural profiles have been found when comparing social skills and language function (Macintosh & Dissanayake, 2004).

In terms of between-groups differences, it was hypothesised that the Asperger's Syndrome Group would present with a higher level of cognitive functioning both globally and at a subtests level. When examining WISC-III scores, differences were found in all the Verbal Subtests with the Asperger's Syndrome group scoring significantly higher than the Autism group in each instance. Significantly higher scores were also found in Coding and Symbol Search, two subtests requiring manual dexterity and the use of fine motor skills. Picture Assembly was another subtest found to be significantly higher in the Asperger's Syndrome group in comparison to the autism group. As well as individual subtest scores, the Asperger's Syndrome group had significantly higher VIQ, PIQ and FSIQ than the Autism group. FSIQ was also found to be higher in persons with Asperger's Syndrome in studies conducted by Manjiviona and Prior (1999) and Ehlers et al. (1997).

Both the WISC and the ABLLS results overwhelmingly support the continuity stance. There are very few significant within-groups differences as hypothesised to show distinctive profiles, but at the same time there are many significant and substantial between-groups differences, including nearly all the WISC and ABLLS measures. Together these results suggests two groups of children that are quantitatively different both on cognitive measures and adaptive skills, but are not qualitatively different in terms of having highly differentiated and individual patterns of adaptive behaviours and cognitive strengths and weaknesses.

The current research project did not use a FSIQ cut-off point of 70 as previous studies have done (Ozonoff et al., 1991; Manjiviona & Prior, 1999; Ghaziuddin & Mountain-Kimchi, 2004; & Koyama et al., 2007). Participants were not excluded on the basis of lower than average IQ scores in order to obtain a more representative sample of children with autism and Asperger's Syndrome. As a result, six children in the Autism group and one child from the Asperger's Syndrome group tested with FSIQ scores lower than 70. It is interesting to note that Gillberg asserted that a diagnosis of autism is rare with a FSIQ higher than 100 (1992), a statement supported by the results of the present study. However, while no children in the Autism group had FSIQ greater than100, only four individuals in the current Asperger's Syndrome sample presented with this level of intelligence.

While Manjiviona and Prior (1999) found similar cognitive profiles in their comparative groups, their samples were restricted by FSIQ within normal ranges. These authors believe that more distinctive profiles may emerge with a broader range of IQ scores

within the two groups. The present study included full scale IQs ranging from 46 to 122, and the results supported the idea of continuity that the disorders exist on a continuum. Although level of IQ is not specified as part of the diagnostic criteria for either autism or Asperger's Syndrome it has been suggested that a higher overall IQ level may be "the cardinal feature that clinicians react to" (p. 344) when making a diagnosis of Asperger's Syndrome.

When first comparing the results from the two groups, a significant age discrepancy was observed with the average age of members of the Asperger's Syndrome group being significantly older than the Autism group. This may be a reflection of the differences in average age of diagnosis for autism and Asperger's Syndrome with the latter being diagnosed on average at 11 years of age (Frith, 2004). Standard deviations were quite similar in size however indicating an even spread of ages in each group. One of the difficulties in conducting assessments when the investigators are blind to the diagnosis is that age could not be controlled for.

It is interesting to note that while the entire sample and in the majority of measures were positively correlated with age, this was not the case for the Asperger's Syndrome group. The lack of correlation between age and subtest score may have something to do with the finding that the presentation of individuals with Asperger's Syndrome and autism become similar with age. Several research papers have proposed a theory that Asperger's Syndrome and autism have different developmental trajectories that converge over time Macintosh & Dissanayake, 2004. Children with Asperger's Syndrome may have more idiosyncratic developmental patterns, including

developmental "plateaus" at various junctures, particularly in verbal abilities. In support of this idea, none of the WISC-III Verbal subtests showed significant or strong age correlations for the Asperger's Syndrome group. Individuals with Asperger's Syndrome may start off with higher than average levels especially when it comes to language development. Diagnosis is often delayed in children who present with superficially superior language. This 'adult-like' or precocious language could possibly be masking other deficits including lack of comprehension which would become more apparent over time. In addition to this, when examining differences in social behaviour, studies have shown that during early childhood individuals with Asperger's Syndrome were reported to demonstrate fewer deficits in social interaction than children with autism but by adolescence, these differences were no longer apparent (Macintosh & Dissanayake, 2004).

Discriminant analysis was conducted in order to ascertain the most reliable discriminators of children presenting with Asperger's Syndrome/autism symptomatology. As well the analysis was used to determine how consistent the diagnostic classifications by experienced diagnosticians using the DSM-IV (1994) and Gillberg and Gillberg Criteria (1989) and their clinical judgement of children exhibiting Autism/Asperger's Syndrome signs and symptoms are in comparison with classifications of the same children made on the basis of objective cognitive and adaptive behavioural measures. Given a group of children presenting with autism/Asperger's Syndrome signs and symptoms, and applying commonly used behavioural and cognitive measures in attempt to classify the children into two theoretically distinctive groups; neither of these types of formal measures was

particularly powerful or reliable in assigning children with these sorts of presenting symptoms into distinctive groups. Neither type of measure was particularly reliable in making diagnoses, although the WISC-III VIQ and the ABLLS Language and Academic subscales in combination have more discriminatory power in separating children with these diagnoses on the Autism continuum, than does the PIQ. When comparing the discriminant analysis results based on the two different types of measures, it seems that neither behavioural measures nor cognitive measures are superior in discrimination, and lead to similar degrees of overlap with clinically-based classification into the two syndromes. VIQ appears to be particularly important in making diagnoses, holding far more discriminatory power in separating children with Pervasive Developmental Disorders, than does PIQ. VIQ is also more discriminating than the combined PIQ/VIQ data, in the form of FSIQ data. The global cognitive measures however, only reliably discriminated a minority of the cases in the sample (19.23%) at the designated .05 level. Nevertheless, despite the lack of reliable discrimination by function, the degree of overlap between classification by diagnostician and by function is very high (88.46%) with one out of the four misclassified cases only marginally and not reliably placed within the group specified by the function.

High degrees of consistency were achieved, attesting to the concurrent validity of objective cognitive and behavioural measures as markers for Asperger's Syndrome and autism, and possibly leading to the endorsement of such objective measures in aiding diagnosis. However, such findings need to be reconciled with the strong evidence in the present study for a continuity stance rather than discontinuity, which is the assumption underpinning all diagnostic systems. It is possible that diagnosticians in making

classifications of children using the available criteria for Asperger's Syndrome and autism make somewhat broader judgments than the criteria would suggest, and these judgments may be guided principally by global evaluations of cognitive and behavioural functioning than might be suggested by the available diagnostic criteria.

On reflection of first raising awareness of Asperger's Syndrome in 1981, Wing published a follow up paper in 2005 and discussed the debate which had ensued regarding whether or not autism and Asperger's Syndrome could be separated based on criteria other than those related to level of ability. In her original paper (1981), Wing made clear arguments about autism and Asperger's Syndrome and how they were not distinct conditions because of their shared deficits in the areas of social interaction, communication and imagination. Gillberg (1992), however, reported that expressive language on a formal level was superior in individuals with Asperger's Syndrome whereas motor skills were relatively stronger in those with autism and concluded that perhaps the disorders were distinct conditions. Studies involving clinicians however, have reported high levels of overlap when diagnosing Asperger's Syndrome and autism concluding that the difficulty in diagnosis reportedly increases when intelligence and speech reach average levels as the diagnostic criteria become almost identical (Cashin, 2006). In a review of 64 studies comparing the two disorders, Wing (2005) found 15 reports concluding that the conditions were different, 29 that found no "important" differences and 20 reports that were unable to reach definite conclusions indicating that on the whole, it has been difficult to find clear evidence to support the notion that the two disorders are discontinuous.

The results of the current study do not indicate any distinctiveness between the two disorders based on cognitive or behavioural measures, but rather a picture of similar cognitive and behavioural profiles expressed at different levels of severity in terms of functioning, with the Asperger's Syndrome group demonstrating higher levels of cognitive and adaptive behaviour skills. The findings are consistent with Wing's original idea (1981) that autism and Asperger's Syndrome may form part of a continuum with Asperger's Syndrome representing a higher functioning group of individuals. This appears to be consistent with Szatmari et al. (1995) who reported that Asperger's Syndrome "may simply be high-IQ autism" (p.1667).

Even with Gillberg and Gillberg's Criteria (1989) where individuals can be diagnosed with Asperger's Syndrome and still have a history of language delay, the Asperger's Syndrome group demonstrated stronger verbal ability. Macintosh and Dissanayake (2004) in reviewing the comparative literature regarding cognitive differences between autism and Asperger's Syndrome surmised that "the decision to either retain or eliminate the criterion specifying an absence of significant language delay in Asperger's Syndrome may determine whether or not group differences are found" (p.425). The authors argued that without the diagnostic distinction of a language delay, few differences may be found between the two disorders. Manjiviona and Prior (1999) however, found that the history of language delay was not a differentiating characteristic between children with autism and Asperger's Syndrome which leads to the concern that current diagnostic criteria are not a true reflection of the disorders being presented to clinicians.

The DSM-IV (APA, 1994) is now 15 years old, even the DSM-IV-TR is nearing 10 years since publication and the Gillberg and Gillberg Criteria (1989) have been published for 20 years without revision. Considering that Asperger's Syndrome was first conceptualised in 1981, the majority of the research relating to this disorder has been generated in the years following the publication of diagnostic criteria. It may be that the diagnostic criteria are not representative of the research that has been conducted over the past decade and the difficulty in diagnosis may not be in the inability to reliably separate the disorders but the inability to effectively apply the diagnostic criteria to a group of individuals consistently presenting with differing symptomology. The body of research, including the current study has repeatedly highlighted the importance of examining cognitive profiles as part of the diagnostic process. Perhaps this should form the basis of where the development of updated diagnostic criteria should head toward.

Limitations and Future Directions

The current study involved a relatively small sample size with 14 participants in the Autism group and 12 in the Asperger's Syndrome sub-sample and therefore the findings should be considered preliminary with a much larger sample required to confirm the results presented. Inherent in the problems associated with diagnosis was the difficulty in finding participants who met the appropriate diagnostic criteria to participate in the study, particularly for the Asperger's Syndrome group. As the primary researcher was blind to each child's diagnosis during the recruitment and assessment process, it was difficult to match individuals on age for each group and as a result the Asperger's Syndrome group was on average, significantly older than the children in the Autism group. Age was controlled for in statistical analysis where possible however the ABLLS

protocol does not yet have age norms or scaled scores which account for age making it difficult to validly compare the two samples.

The ABLLS protocol is an invaluable tool for assessing the level of functioning of children, in particular those with language delays, however during the assessment process, the protocol appeared to have a low ceiling in older children. For many children aged over the age of eight years, full scores were given for subscales including Visual Performance, Receptive Labels, Reading, Writing, Toileting and Fine and Gross Motor. This may not have given a clear representation of any differences of children between the ages of 8 and 13 years.

One area not specifically measured with either the WISC-III or the ABLLS is the area of interpreting non-verbal cues, a deficit singled out in both the autism and Asperger's Syndrome diagnostic criteria. A behavioural measure could be utilised to test the ability to read non-verbal cues and ascertain if the disorders can be differentiated on this measure.

Future directions may include conducting a longitudinal study comparing children diagnosed with Asperger's Syndrome and autism over time to test the hypothesis that the two disorders have differing developmental trajectories that converge over time. Comparing the changing cognitive and behavioural profiles over time may also provide interesting results and indicate whether autism and Asperger's Syndrome do in fact have differing developmental paths which may cross or merge over time. It may also be advantageous to compare the profiles of very young children as research has

demonstrated that differences between autism and Asperger's Syndrome may be more pronounced during the first years of life (Macintosh & Dissanayake, 2004).

While more evidence is emerging to confirm that Asperger's Syndrome exists on a continuum with autism, caution needs to be taken that the Asperger's Syndrome label is not abandoned all together in the support of an 'autistic spectrum'. With the term first being reported in 1981, the term Asperger's Syndrome has rapidly become part of the psychological vernacular and has raised awareness of a group of individuals who often went undiagnosed or misdiagnosed because their presentation did not fit the classic 'Kanner' autism profile. As Frith (2004) reported, Asperger's Syndrome has now become "almost a household name" (p.673) and has seen an increase in public awareness. The popularity of the disorder as portrayed in the media speaks to the resonance Asperger's Syndrome has with the general public and is seen in the number of characters on popular TV dramas such as House, Boston Legal, Bones, Law and Order and movies such as Mary and Max and Adam in 2009 alone.

In conclusion of her paper "Reflections on Opening Pandora's Box", Wing (2005) wrote "the story of autism and Asperger's Syndrome attests to the truth of three wise sayings. There is nothing new under the sun. Nothing exists until it has a name. Nature never draws a line without smudging it" (p.202). As clinicians working in the field can attest, diagnosing a disorder using only behavioural markers which may fluctuate depending on the time or place is extremely difficult. The amount of variability in individuals with autism is substantial and it is little wonder that no reliable measure has been identified to validate a diagnosis let alone distinguish between two seemingly similar disorders.

In summary, the current study adds credence to Wing's original notion that Asperger's Syndrome and autism exist on a continuum with the two disorders only differing in terms of severity. Although higher functioning in both cognitive and behavioural measures, the Asperger's Syndrome group presented with a similar profile to that seen in the Autism group. Research has suggested that older individuals with autism, particularly High-Functioning Autism, share many features with Asperger's Syndrome to the point where it is difficult to distinguish between the two diagnoses (Frith, 2004). Perhaps future research can investigate whether or not the continuity between the two syndromes exists at different developmental stages.

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Appendix A
Early Classification of Autism

Year	Publication	Classification	Onset	Criteria
1952	DSM-I	Schizophrenic Reaction, Childhood Type	Before Puberty	The clinical picture may differ from schizophrenic reactions occurring in other age periods because of the immaturity and plasticity of the patient at the time of onset of the reaction. Psychotic reactions in children, manifesting primarily autism, will be classified here. Special symptomatology may be added to the diagnosis as manifestations.
1968	DSM-II	Schizophrenia, Childhood Type	Before Puberty	The condition may be manifested by autistic, atypical, and withdrawn behaviour; Failure to develop identity separate from the mother's; General unevenness, gross immaturity and inadequacy in development. These developmental defects may result in mental retardation, which should also be diagnosed.
1980	DSM-III	Infantile Autism	Before 30 months	Pervasive lack of responsiveness to other people. Gross deficits in language development. If speech is present, peculiar speech patterns such as immediate and delayed echolalia, metaphorical language, pronominal reversal. Bizarre responses to various aspects of the environment, e.g., resistance to change, peculiar interest in or attachments to animate or inanimate objects. Absence of delusions, hallucinations, loosening of associations, and incoherence as in Schizophrenia

Source: In DSM (American Psychiatric Association (APA), 1952), DSM-II (APA, 1968), DSM-III, (APA, 1980).

Appendix B

Description of Psychoses of Infancy and Childhood Within the Proposed Classification System of Psychopathological Disorders of Childhood by GAP, 1966

Psychoses of Infancy and Early Childhood

1. *Early Infantile Autism,* considered to be the primary problem, is to be distinguished from the secondary form, in which autism or self-referent behaviour follows brain damage or mental retardation. Early infantile autism appears to have its onset during the first few months or the first year of life, with failure on the part of the infant to develop an attachment to the mother figure. The infant remains aloof, showing little apparent awareness of human contact, and is preoccupied with inanimate objects. Speech development is delayed or absent; when it appears, speech is not employed appropriately or for purposes of communication. The child shows a strong need for the maintenance of sameness and tends to resist change, responding with marked outbursts of temper or acute and intense anxiety when routines are altered. Sleeping and feeding problems are often severe. Stereotyped motor patterns, often bizarre or primitive in nature, are frequent. Intellectual development may be normal or advanced or it might be restricted and uneven in areas. In any case, the lack of capacity to perceive reality correctly and to communicate through speech may render most intellectual functions ineffective.

2. *Interactional psychotic disorder:* This category covers children with symbiotic psychosis; the group referred to is a wider one, however, embracing other cases with somewhat different features, and symbiotic parent-child relationships may be seen in disorders other than psychoses. Many of these are children who by their histories seem to have developed reasonably adequately for the first year or two of life, with awareness of or attachment to the mother figure appearing during the first year. Subsequently the child may show unusual dependence upon the mother in the form of an intensification and prolongation of the attachment, apparently failing to master successfully the step of separation and individuation. In the second to fourth or fifth year, the onset of the psychotic disorder occurs, ordinarily in relation to some real or fantasised threat to the mother-child relationship. The young child often rather suddenly shows intense separation anxiety and clinging, together with regressive manifestations , the latter frequently including the giving up of communicative speech. The picture is usually one of gradual withdrawal, emotional aloofness, autistic behaviour, and distorted perception of reality, to a point which may resemble infantile autism. Rarely, the father or another family member may become the interactional partner, as the result of a shift in parental or familial roles. Alternating psychotic pictures in twins are also seen occasionally, beginning in early childhood, as in other interactional patterns.

3. *Other psychosis of infancy and early childhood* is a category for pictures not conforming strongly to that of either early infantile autism or interactional psychosis, although they may show some features of each. It includes children of atypical development who exhibit some autistic behaviour and emotional aloofness. Such children may, however, show some strengths in adaptive behaviour and assets in personality development. Differentiation must be made from children with developmental lags in cognitive functioning, those with marked depression and apathy, those who may be identifying with a psychotic parent or other person, those with intense anxiety and inhibition leading to the picture of the "frozen" child with action paralysis, or those with other clinical entities.

Source: In Psychopathological Disorders in Childhood: Theoretical Considerations and a Proposed Classification (Group for the Advancement of Psychiatry, 1966).

Appendix C

DSM-III-R Classification of Autistic Disorder

Classification	Onset	Criteria
Autistic Disorder	During Childhood	At least eight of the following sixteen items are present, these to include at least two items from A, one from B, and one from C. **Note:** Consider a criterion to be met *only* if the behaviour is abnormal for the person's developmental level. A. Qualitative impairment in reciprocal social interaction as manifested by the following: (1) marked lack of awareness of the existence or feelings of others (2) no or abnormal seeking of comfort at times of distress (3) no or impaired imitation (4) no or abnormal social play (5) gross impairment in ability to make peer friendships B. Qualitative impairment in verbal and nonverbal communication, and in imaginative activity, as manifested by the following: (1) no mode of communication, such as communicative babbling, facial expression, gesture, mime, or spoken language (2) markedly abnormal nonverbal communication, as in the use of eye-to-eye gaze, facial expression, body posture, or gestures to initiate or modulate social interaction (3) absence of imaginative activity, such as playacting of adult roles, fantasy characters, or animals; lack of interest in stories about imaginary events (4) marked abnormalities in the production of speech, including volume, pitch, stress, rate, rhythm, and intonation (5) marked abnormalities in the form or content of speech, including stereotyped and repetitive use of speech; use of "you" when "I" is meant; idiosyncratic use of words or phrases; or frequent irrelevant remarks (6) marked impairment in the ability to initiate or sustain a conversation with others, despite adequate speech C. Markedly restricted repertoire of activities and interests, as manifested by the following: (1) stereotyped body movements, e.g., hand-flicking or -twisting, spinning, head-banging, complex whole-body movements (2) persistent preoccupation with parts of objects or attachment to unusual objects (3) marked distress over changes in trivial aspects of environment, (4) unreasonable insistence on following routines in precise detail, (5) markedly restricted range of interests and a preoccupation with one narrow interest. D. Onset during infancy or childhood. Specify if childhood onset (after 36 months of age).

Source: In the DSM-III-R (APA, 1987)

Appendix D

DSM-IV Criteria for Autistic Disorder.

1994	DSM-IV	Autistic Disorder	Before 36 months	I. *A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):* 1) Qualitative impairment in social interaction, as manifested by at least two of the following: a) marked impairment in the use of multiple nonverbal behaviours such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction. b) failure to develop peer relationships appropriate to developmental level c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest) d) lack of social or emotional reciprocity 2) Qualitative impairments in communication as manifested by at least one of the following: a) Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime) b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others c) stereotyped and repetitive use of language or idiosyncratic language d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level 3) Restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities, as manifested by at least of one of the following: a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus b) apparently inflexible adherence to specific, nonfunctional routines or rituals c) stereotyped and repetitive motor mannerisms (e.g. hand or finger flapping or twisting, or

				complex whole body movements) d) persistent preoccupation with parts of objects II. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play. III. The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder.

Source: In the DSM-IV (APA, 1994).

Appendix E

Diagnostic Criteria for Asperger's Syndrome.

	DSM-IV (1994)	ICD-10 (1993)	Gillberg & Gillberg Criteria (1989)	Szatmari et al. (1989)
Social Interaction	**Qualitative impairment in social interaction, as manifested by at least two of the following:** 1.marked impairment in the use of multiple nonverbal behaviours such as eye gaze, facial expression, body postures, and gestures to regulate social interaction 2.failure to develop peer relationships appropriate to developmental level 3.a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people) 4.lack of social or emotional reciprocity	Qualitative abnormalities in reciprocal social interaction (criteria as for autism).	**Severe impairment in reciprocal social interaction** (at least two of the following) (a) inability to interact with peers (b) lack of desire to interact with peers (c) lack of appreciation of social cues (d) socially and emotionally inappropriate behaviour	**Impaired social interaction, as manifested by at least one of the following five:** 1.Approaches others only to have own needs met. 2.A clumsy social approach. 3.One-sided responses to peers. 4.Difficulty sensing feelings of others. 5.Detached from feelings of others. **Solitary, as manifested by at least two of the following four:** 1. No close friends. 2. Avoids others. 3. No interest in making friends. 4. A loner.

	DSM-IV	ICD-10	Gillberg	Szatmari
Language	There is no clinically significant delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years)	A lack of any clinically significant general delay in spoken or receptive language or cognitive development. Diagnosis requires that single words should have developed by two years of age or earlier and that communicative phrases be used by three years of age or earlier.	**Speech and language problems** (at least three of the following) (a) delayed development (b) superficially perfect expressive language (c) formal, pedantic language (d) odd prosody, peculiar voice characteristics (e) impairment of comprehension including misinterpretations of literal/implied meanings	**Odd speech, as manifested by at least two of the following six:** 1.abnormalities in inflection. 2.talks too much. 3.talks too little. 4.lack of cohesion to conversation. 5.idiosyncratic use of words. 6.repetitive patterns of speech.
Cognitive Development and Adaptive Behaviour	There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behaviour (other than in social interaction), and curiosity about the environment in childhood	Self-help skills, adaptive behaviour and curiosity about the environment during the first three years should be at a level consistent with intellectual development. However, motor milestones may be somewhat delayed and motor clumsiness is usual (although not a necessary diagnostic feature). Isolated special skills, often related to abnormal preoccupations, are common, but are not required for diagnosis.	Motor clumsiness: poor performance on neuro-developmental examination	

	DSM-IV	ICD-10	Gillberg	Szatmari
Restricted Interests		An unusually intense circumscribed interest or restrictive, repetitive, and stereotyped patterns of behaviour, interests and activities (criteria as for autism; however, it would be less usual for these to include either motor mannerisms or preoccupations with part-objects or non-functional elements of play materials).	**All-absorbing narrow interest** (at least one of the following) (a) exclusion of other activities (b) repetitive adherence (c) more rote than meaning **3. Imposition of routines and interests** (at least one of the following) (a) on self, in aspects of life (b) on others	
Non-verbal Communication			**Non-verbal communication problems** (at least one of the following) (a) limited use of gestures (b) clumsy/gauche body language (c) limited facial expression (d) inappropriate expression (e) peculiar, stiff gaze	**Impaired non-verbal communication, as manifested by at least one of the following seven:** 1.Limited facial expression. 2.Unable to read emotion from facial expressions of child. 3.Unable to give messages with eyes. 4.Does not look at others. 5.Does not use hands to express oneself. 6.Gestures are large and clumsy. 7.Comes too close to others.

	DSM-IV	ICD-10	Gillberg	Szatmari
Other	The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia	The disorder is not attributable to other varieties of pervasive developmental disorder; schizotypal disorder (F21); simple schizophrenia (F20.6); reactive and disinhibited attachment disorder of childhood (F94.1 and .2); obsessional personality disorder (F60.5); obsessive-compulsive disorder (F42).	(All six criteria must be met for confirmation of diagnosis.)	Does not meet criteria for Autistic Disorder.

Source: In the DSM-IV (APA, 1994) and the ICD-10 (WHO, 1993), Gillberg & Gillberg Criteria (1989), Szatmari et al. Criteria (1989).

Appendix F
Assessment of Basic Language and Learning Skills (ABLLS)

Appendix G

UNIVERSITY OF TASMANIA

1st January, 2009

Cognitive and Behavioural Profiles of Autism and Asperger's Syndrome: Are They Distinctive?

Dear Parent,

My name is Cassie le Fevre and I am currently completing a Master's Degree in Clinical Psychology at the University of Tasmania. Part of the degree requirement is to complete a research project. I am being supervised by Dr Rosanne Burton Smith, a developmental psychologist and lecturer in the School of Psychology, who has had extensive experience in the assessment and treatment of children with a range of disabilities.

I have chosen Autism and related disorders as my area of study. I have been working with children diagnosed with Autism for a number of years both in Tasmania and now in Sydney at the Lizard Children Centre. While working with children it became apparent to me that the lack of a firm diagnosis can be a problem for both parents and professionals working with children who have been identified as having an autism spectrum disorder.

The purpose of the study is to investigate the differences between children diagnosed with Autism and Asperger's Syndrome. I would like to establish whether there are any differences in how children with these syndromes think and behave. This will help professionals such as doctors and psychologists to accurately diagnose children and this in turn will lead to better and more effective treatments.

I would like to invite you and your child to take part in the research project. The research involves observing and testing children aged between five and thirteen years who meet the diagnostic criteria for either Autism or Asperger's Syndrome, and interviewing their parents or guardians. If your child has not received a formal diagnosis of either autism or Asperger's Syndrome or has not been assessed in the past three years, an experienced clinician will first make an independent diagnosis of your child by observing him or her and by interviewing you and/or your partner (parent interview). The experienced clinician is entirely independent of the university and you will incur no cost for the assessment. Results of these assessments will be confidential and you will be present and consulted during the diagnostic process. Once the clinician has made their diagnosis, you will be informed of the result and you will have an opportunity to discuss the findings with the clinician. The results of the diagnosis will be confidential. If your child has already received a diagnosis from an experienced clinician, your child will only need to participate in the second phase of the study. It is important to note that children with an additional diagnosis of Attention Deficit/Hyperactivity Disorder (ADHD) will not be eligible to participate in the study.

I will assess your child using a well-known and standardised intelligence test (the Wechsler Intelligence Scale for Children – III) and the Assessment of Basic Language and Learning Skills (ABLLS). These assessments will give a detailed picture of your child's abilities. Assessments will be conducted over two two-hour sessions. If necessary, shorter sessions can be arranged for you and your child. You will be able to observe the assessment if you wish. Because the aim of the study is to determine a correlation between the clinician's diagnosis and the assessment, I will not know the outcome of the clinician's diagnosis until after my assessment is completed. At this time, I may ask to view a copy of the diagnostic report in order to record your child's official diagnosis.

Sometimes children with Autism can become distressed in new environments or when demands are placed on them, such as in an assessment. I will spend some time with your child prior to the assessment in order to give your child time to adjust to the new environment and get to know me. Your child can also bring along a toy, book or familiar item with them to the assessment to help them feel more comfortable. If your child becomes distressed, the assessment will cease immediately. There is no obligation to complete the assessment, and if you withdraw from the study at any time, it will not prejudice you or your child in any way, for example in receiving future treatment or services.

All participants' results will be coded when entered onto a computer data base, so that you and your child will remain anonymous. Any reports or publications which arise from the results of this study will not identify individuals. All assessment forms will remain confidential, and will be kept in a secure location in the School of Psychology, University of Tasmania. Individual children's assessment details and diagnosis will only be accessed by the investigators in this study whose signatures appear below, and any forms will be destroyed by shredding after a period of five years. If you wish, you will be given detailed feedback on your child's results. At the completion of the study, overall results will be available in the form of a written report that will be sent to you upon request.

This project has received ethical approval from the Human Research Ethics Committee (Tas) Network. Your entry into the research project is completely voluntary and as previously stated you can withdraw your child at any stage of the research without prejudice. If you have any concerns of an ethical nature or complaints about the way in which the project is conducted, you may contact the Executive Officer of the Network, Marilyn Pugsley, (03 6226 7479)

If you have any queries regarding this project, please do not hesitate to contact myself on 04 .... or Dr Rosanne Burton Smith on 03 62262241.

Thank you for your time.

Dr. Rosanne Burton Smith Chief Investigator	Cassie le Fevre Master's Student

Appendix H

CONSENT FORM

Cognitive and Behavioural Profiles of Autism and Asperger's Syndrome: Are they Distinctive?

1. I have read and understood the 'Information Sheet' for this study.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study involves the following procedures:
    a. Two two-hour assessment sessions (or equivalent) involving my child who will be administered the WISCIII and the ABLLS
4. I understand that I will not be charged for the two assessment sessions.
5. I understand that the diagnosing clinician (_____) will provide clinical information including my child's diagnosis to the researchers.
6. I understand that the following risks are involved: That my child may become upset or distressed by the assessment procedures or the unfamiliar environment. I understand that assessment will cease immediately if this should occur, or at my request.
7. I understand that any information I supply will be dealt with confidentially by the researchers.
8. I understand that all research data will be securely stored on the University of Tasmania premises for a period of 5 years. The forms relating to my child's assessment will be destroyed by shredding at the end of 5 years.
9. Any questions that I have asked have been answered to my satisfaction.
10. I agree that research data gathered for the study may be published provided that my child or I cannot be identified as a subject.
11. I give permission for my child to participate in this investigation and understand that I may withdraw my child at any time without any effect on my access to treatment or services for myself or my child.

Name of participant _____

Name of Parent or Guardian _____

Signature of participant Date

_____ _____

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of investigator _____

Signature of investigator _____ Date _____